

Safe Work Practices



Phasing Sticks	Reference:	SWP-2.04	Revision:	1
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1.0 GENERAL DESCRIPTION

Phasing testers are used to quickly determine the phase relationship between conductors in a three phase power system. Some units permit the measuring of AC voltage on distribution and transmission circuits up to 800kV, while others will give phasing angles.

2.0 HASTINGS PHASE TELL III (CORDLESS):

- 2.1 Designed to be attached to approved length of hot stick
- 2.2 Two wireless Phase-Tell III's perform a continuous comparison of the phase relationship.
- 2.3 Three multi-colors, ultra- bright LED's indicate the status of the unit.
- 2.4 Wide range of operation from elbow test points to 500kV.
- 2.5 Both units report the test result.

3.0 HD ELECTRIC VOLTMETER/PHASER

- 3.1 Designed to be attached to approved length of hot stick
- 3.2 Constructed with epoxy encapsulated high voltage resistors, a connecting cord and a meter display.
- 3.3 Current is limited through the connecting cord to a maximum of 1 milliamp.
- 3.4 Insulated cord up to 10kV but should always be kept free and clear from the worker, ground and any other conductors.

4.0 BIERER PD800W (CORDLESS)

- 4.1 Designed to operate similar to conventional testers, but easier to use because it does not require interconnect cable.
- 4.2 Consists of a Reference Probe (transmitter) and a Meter Probe (receiver).
- 4.3 Operates reliably at distances up to 100 feet.
- 4.4 Useable from 120V to 800Kv

5.0 WARNING - See "attached" product safety information for unit (See 2.04 A-D)

- 5.1 This training will give a general account of using various phasing tools.
- 5.2 The principles, operation, and safety issues in this training are generic. If you are unfamiliar with the operation of an individual unit, DO NOT PROCEED. Contact your supervisor immediately.

6.0 PRE-USE INSPECTION

- 6.1 Keep all parts clean, dry and shiny surfaces waxed.
- 6.2 For units with a cord, inspect the insulation for cracks.
- 6.3 Be certain the hot stick is appropriately rated and the correct length.
- 6.4 Examine to insure that the stick is clean, dry and waxed to a clear shiny surface.
- 6.5 Attach the appropriate probes
- 6.6 Turn the unit on and run through the startup self-test, if applicable.
- 6.7 See additional instructions per attached individual safety manuals.

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7.0 TESTING

- 7.1 It is recommended that two person crews perform all line-to-line measurements.
- 7.2 In order to make line-to-line measurements, each probe must contact an energized line.
- 7.3 Always keep the connecting cord (if applicable) free and clear of energized phases and ground.
- 7.4 To check all phases proceed as follows:
 - a. Check voltage to be present
 - b. Place one of the probes on a conductor from one side of the test.
 - c. Place the other probe on one of the other three phases on the other side.
- 7.5 When phasing conductors:
 - a. The HD Electric meter will read line-to-line voltage. If they are in phase, the meter will read zero (or near zero).
 - b. On the Bierer unit, the LED's will indicate 120° or 240° out of phase
 - c. Hastings Phase Tell III, if in phase green LED or out of phase will have red LED. Continue this procedure with all three phases on both sides of the test.
- 7.6 The Bierer reference unit will have a white LED indicating the presence of voltage @ the minimum approach distance.
- 7.7 Also, the Bierer selector switches on the Reference Probe and Meter Probe must be in the same position. Failure to do so could produce false readings, resulting in equipment damage and/or personal injury.

8.0 RECORD RESULTS

- 8.1 It may be useful and possibly necessary to record the results of the phasing test.
- 8.2 By utilizing a simple diagram to record the data, a crew could ensure they had the correct connections when taps were to be made.
- 8.3 Taping phases with colored tape may also be useful.

9.0 ATTACHMENTS (Operator's Manuals from Manufacturer)

- 2.04A – Bierer PD800W
- 2.04B – Hastings 6722 – Phase Tell III
- 2.04C – HD Electric
- 2.05D - HD Electric DVM-80UVM

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PD800W™
PD Series Cordless
Phasing Tester
Operating Instructions

CE

Patent No. 6,617,840 and 6,734,658



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Limitation of Warranty and Liability

Bierer & Associates Inc. warrants this product to be free from defects in workmanship and material, under normal use and service conditions for a period of one year from date of shipment.


Due to continuous product improvement and development, Bierer & Associates Inc. reserves the right to modify product designs and specifications without notice.


It is impossible to eliminate all risks associated with the use of high voltage electrical devices including this device. Risks of serious injury or death are inherent in working around energized electrical systems. Such risks include but are not limited to variations of electrical systems and equipment, manner of use or applications, weather and environmental conditions, operator mentality, and other unknown factors that are beyond the control of Bierer & Associates Inc.


Bierer & Associates Inc. do not express or imply to be an insurer of these risks, and by purchasing or using this product you **AGREE TO ACCEPT THESE RISKS. IN NO EVENT SHALL Bierer & Associates Inc. BE LIABLE FOR ANY INCIDENTAL, CONSEQUENTIAL OR SPECIAL DAMAGES RESULTING FROM THE USE OR HANDLING OF THIS PRODUCT.**


SAFETY MESSAGE DEFINITIONS per ANSI Z535

These instructions contain important safety messages to alert the user to potentially hazardous situations, how to avoid the hazard, and the consequences of failure to follow the instruction.

The safety alert symbol  identifies a safety message. The signal word following the symbol indicates:

 **DANGER** A hazardous situation which, if not avoided, will result in death or serious injury and equipment damage.

 **WARNING** A hazardous situation which, if not avoided, could result in death or serious injury and equipment damage.

 **CAUTION** A hazardous situation which, if not avoided, could result in minor or moderate injury and equipment damage.

NOTICE Important safety message relating to equipment damage only.

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PRODUCT SAFETY INFORMATION

WARNING

1. Meter assembly and live line tool adapters shall be considered **non-insulating**. Do not let live line tool fittings come in contact with energized or grounded conductors. The live line tool adapters, fittings, and handles supplied with meters shall not be used on any other devices.
2. Use appropriate length live line tools for voltage being worked and maintain minimum approach distances as outlined in OSHA 1910.269, Table R-6.
3. All Phasing Meters and Voltage Detectors manufactured during and after 2007 will have a limit mark engraved on the high voltage probe(s) 2.5 inches from the tip to indicate to the user the physical limit that should not be exceeded when approaching and contacting an electrical conductor or other electrical test points. Zero Ohm insulated adapters (81280IE) should be used if limit mark will be exceeded.
4. This equipment should be used only by qualified employees, trained in and familiar with the safety-related work practices, safety rules and other safety requirements associated with the use of this type of equipment.
5. These instructions are not intended as a substitute for adequate training, nor do they cover all details or situations which could be encountered when operating this type of equipment.
6. Before operating this equipment, read, understand and follow all instructions contained in this manual. Keep instructions with equipment.

INSPECTION & MAINTENANCE BEFORE USE

WARNING

1. Prior to using any high voltage test equipment a careful inspection should be made to ensure the unit is free from any contaminants such as dirt, grease, etc. and that there are no apparent physical damages.
2. High voltage probe assemblies shall be wiped clean prior to each use with a silicone impregnated cloth and kept clean and free of contaminants. This will prevent tracking on the outside of the probe and meter error.
3. Always confirm internal battery voltage before and after use.

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DESIGN and FUNCTION



WARNING – Limit Mark

-see “Product Safety Information”, item 3, page 3.

The cordless PD800W is designed to operate similar to a conventional phasing tester, but is easier to use because it does not require an interconnect cable. The unit consists of a Reference Probe (transmitter) and a Meter Probe (receiver) and will operate reliably at distances up to 100 feet. The phasing tester is useable from 120V to 800kV.

Each unit has a five-position switch for the following functions:

Off – Unit off for storage or transport.

Deg – Phase angle measurement in degrees for use on Secondary, URD and Overhead. Direct contact from 120V to 51kV (including capacitive test points). Non-contact from 51kV to 800kV

URD – Phasing Underground Residential Distribution with Voltage Indications. Direct contact from 4kV to 51kV (not for capacitive test points).

OH – Phasing Over-Head conductors with voltage indications Direct contact from 4kV to 51kV.

T – Tests basic meter function and displays the internal 9V battery voltage.

Voltage indications and degree readings are supplemented with phase indicator lights on the Meter Probe for dual confirmation of the phase relationship between the Reference Probe and Meter probe.

0° - indicates an in-phase condition.

120° - indicates out-of-phase condition of 120 degrees.

240° - indicates an out-of-phase condition of 240 degrees.

“DY”- blinking light indicates a Delta/Wye transformation (30 degree phase shift) in conjunction with one of the other three phase indicator lights.

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Note 1: For best results, always position the Reference Probe and Meter Probe perpendicular to the conductors being tested and away from all other conductive surfaces such as adjacent phases, neutrals and grounded structures. Maintain a minimum distance of two feet between the body of the probes and all other conductors or grounded surfaces. Maintain a minimum distance of two feet between your hands and the body of the probe regardless of the voltage being tested. Never hold the tester with rubber gloves when in use.

Note 2: When phasing on URD transformer bushings use 8128TBALB Bushing Adapters on both the Reference and the Meter Probe.

BATTERY REPLACEMENT for LCD and LED PROBES

The threaded live line tool fitting on the face of the **LCD** meter probe is furnished with two flat edges for use with a wrench or slip joint pliers to remove and install the fitting from the meter housing. The live line tool fitting on the face of the **LED** meter probe is furnished with a hole for use with a screw driver to insert and remove or install the fitting from the meter housing. To remove, turn the live line tool fitting in a counterclockwise direction and install in a clockwise direction.

WARNING

- When in operation the selector switches on the Reference Probe and Meter Probe must be in the same position. Failure to do so could produce false readings, resulting in equipment damage and/or personal injury. Always check the selector switch on both units before and after each use.

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METER SET-UP and TESTING



WARNING

- see “Product Safety Information”, page 3.
- see “Inspection & Maintenance”, page 3.

Testing the Meter Probe:

The Meter Probe completes a self check each time the selector switch is moved from one position to another. It displays the number 51.0 +/- 5 (full scale) and blinks 0, 120, 240 phase sequence indicator lights followed by a blinking D (Delta/ Wye Transformation) indicator light.

Test:

The internal 9V battery voltage may be checked by turning the rotary selector switch to the T position and holding for several seconds until the indicator lights stop blinking. If the battery voltage displayed is less than 8 volts, shown on the meter as 80, the battery should be replaced. A standard 9 volt battery is located behind the live line tool attachment.

Testing the Reference Probe:

Turn the Meter Probe selector switch to the URD or OH position. The results of the Reference Probe self checks will be displayed on the Meter Probe. Each time the selector switch on the Reference Probe is moved from one position to another, the number 51.0 will be displayed on the Meter Probe for several seconds.

Test:

The internal 9V battery is checked by turning the selector switch to the T position and holding for several seconds. The internal battery voltage of the reference will be displayed on the Meter Probe. If the battery voltage displayed on the Meter Probe is less than 8V, shown on meter as 80, the battery should be replaced. A standard 9 volt battery is located behind the live line tool attachment.



WARNING

- When in operation the selector switches on the Reference Probe and Meter Probe must be in the same position. Failure to do so could produce false readings, resulting in equipment damage and/or personal injury. Always check the selector switch on both units before and after each use.

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PHASE ANGLE MEASUREMENTS

Direct Contact from 120V to 51kV including Capacitive Test Points



WARNING – see “Meter Set-Up & Testing”, page 6.

1. Attach the Reference and Meter Probe to the appropriate length live line tool for the voltage being tested. Minimum 2 feet (See Note 1 Pg. 5)
2. Set the selector switch on both probes to the Deg position.
3. With the Reference Probe, touch all conductors one at a time to verify all of the phases are energized. (See Note 2 on Page 5).
4. The White phase indicator light will be on if there is at least 120 volts present on the conductor.
5. Touch both the Reference Probe and the Meter Probe to a single (the same) energized conductor. The Meter Probe should indicate near zero degrees on the digital display and show a zero degree indication light. A 0° light on the meter probe indicates an in phase condition. (See Note 2 on Page 5).
6. Leave the Reference Probe on the first energized conductor. Touch the Meter Probe to another energized conductor.
7. If the conductors are in phase, the Meter Probe should indicate near zero degrees on the digital display and show a zero degree indication light.
8. If the conductors are out of phase, the Meter Probe will indicate either of the following:
 - a. Nominal 120 degrees and a 120 degrees indicator light or
 - b. Nominal 240 degrees and a 240 degrees indicator light.



WARNING – see “Meter Set-Up & Testing”, page 6.

Delta/ Wye Transformation

The PD800W provides an additional feature of flagging a Delta Wye Transformation with a blinking yellow indicator light labeled "DY". Expected phase angles when phasing a three-phase system are 0 degrees, 120 degrees, and 240 degrees. The PD800W continuously monitors all phase angles between the Reference Probe and the Meter Probe when used in either the Deg, URD, or OH mode. If the phase angle deviates more than +/- 20 degrees from any of the three expected values of 0, 120, or 240 degrees the Yellow "DY" light will blink.

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PHASE ANGLE MEASUREMENTS

Non-Contact from 51kV to 800kV



WARNING – see “Meter Set-Up & Testing”, page 6.

1. Attach the Reference and Meter Probe to appropriate length live line tools for the voltage being tested. Minimum 2 feet (See Note 1 on pg. 5)
2. Select the **OH** position on the Reference Probe.
3. Bring the Reference Probe to a distance from each conductor that is close to the minimum approach distance for the voltage being tested to verify all conductors are energized. (See OSHA 1910-269, Table R-6 for a **minimum approach distance**).
4. The **White** phase indicator light will be on if the electric field present at the minimum approach distance equals at least 600 volts.
5. Reset the selector switches on both probes to the **Deg** position.
6. Bring both the Reference Probe and Meter Probe close to the minimum approach distance of a single (the same) conductor. The Meter Probe should indicate near zero degrees on the digital display and show a **0°** indication light.

NOTE 3: On lines 51kV to 600kV the Reference Probe may be suspended from the conductor with optional insulated support hook attachment PD800SH2. Above 600kV use PD800SH4. Meter Probe must be used in non-contact mode as described above in No. 6.

7. Leave the Reference Probe in position with the first conductor. Bring the Meter Probe close to the minimum approach distance of another energized conductor.
8. If the conductors are in phase, the Meter Probe should indicate near zero degrees on the digital display and show a **0°** indication light.
9. If the conductors are out of phase, the Meter Probe will indicate either of the following:
 - a) Nominal 120 degrees and a **120** degrees indicator light or
 - b) Nominal 240 degrees and a **240** degrees indicator light



WARNING – see “Meter Set-Up & Testing”, page 6.

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VOLTAGE INDICATIONS URD and OH

Direct Contact from 4kV to 51kV (Does not include Capacitive Test Points)

By design, the PD800W consists of two individual direct contact voltage detectors which communicate with each other via a radio link. When used to display voltage in the URD or OH positions, the readings are a composite of the actual voltage on the line and the capacitive coupling between the live line tool fitting (quick change, universal, or grip all) to other potentials in the vicinity.

If the live line tool fitting is close to another phase, ground or other voltage source, the reading will be higher than normal. If the live line tool fitting is close to conductors or equipment of the same phase, the reading will be lower than normal. In the PD800W, the phase to phase voltage indications are derived from the two phase to ground voltages present on the Reference Probe and the Meter Probe. The resulting phase to phase reading will be proportional to the phase to ground readings.

Example: If due to field conditions both the Reference Probe and Meter Probe sense 9kV phase-to-ground on a 7.2 kV phase to ground system, the phase-to phase indication would be 16 kV rather than 12 kV. In this example, the meter is simply indicating that the two conductors are out of phase. The out of phase condition will be confirmed with the presence of a Blue or Red indicator light.

Note 4: Higher than normal reading in the OH position can sometimes be lowered closer to normal by retesting in the URD position, especially when used in close proximity to neutrals and other grounded surfaces.

Inspect and Test the Unit. Attach the Reference Probe and/or the Meter Probe to the appropriate length live line tool for the voltage being tested. Minimum 2 feet. (See Note 1 on Page 5)

1. Phase-to-Phase Voltage Indication - Direct Contact from 4kV to 51kV Does not include Capacitive Test Points

Normal phase-to-phase voltage indications may be obtained in the URD or OH position by touching one energized phase conductor with the Reference Probe and one energized phase conductor with the Meter Probe. (See Note 1 on Page 5)

2. Zero-Voltage Indication - Direct Contact from 4kV to 51kV Does not include Capacitive Test Points

Normal zero-voltage indication may be obtained in the URD or OH position by touching the Reference Probe and Meter Probe to energized conductors of the same phase and voltage. (See Note 1 on Page 5)

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VOLTAGE INDICATIONS URD and OH (cont'd.)

Direct Contact from 4kV to 51kV
(Does not include Capacitive Test Points)

3. Phase-to-Ground Voltage Indication - Direct Contact from 4kV-to-51kV

Does not include Capacitive Test Points

The Meter Probe may be used in the URD or OH position as a stand alone digital voltage detector to obtain a phase-to-ground voltage indication by touching the energized conductor directly. When using the Meter Probe in this manner, the Reference Probe must be switched off and should be stored in the padded box.

4. Reference Probe as a Voltage Detector - Direct Contact from 240V to 51kV

Including Capacitive Test Points

The Reference Probe may be used as a stand alone voltage detector by touching the energized conductor or capacitive test point directly. The White indicator light will be on if the voltage is equal to or greater than the threshold values below (See Note 1 on Page 5).

- a) Deg position: 240V
- b) URD or OH position: 800V

Use (a) above for capacitive test points and voltages up to 480V and use (b) above for voltages 600V-to-51kV

5. Non-Contact from 51kV to 800kV

The Reference Probe may be used as a non-contact stand alone voltage detector. The presence of an electric field at the minimum approach distance will cause the White indicator light to come on. (See OSHA 1910.269, Table R-6 for minimum approach distance).

Deg Electric field greater than 120V at the minimum approach distance.

URD or OH Electric field greater than 800V at the minimum approach distance.

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FCC INSTRUCTIONS TO THE USER

This equipment (Reference Probe) has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not used in accordance with this instruction manual may cause interference to radio communications. Operation of this equipment in a residential area is likely to cause interference in which case the user is encouraged to try to correct the interference by one or more of the following measures:

1. Reorient or relocate the equipment.
2. Increase the separation between the equipment and the radio service that is experiencing the interference.
3. Consult the dealer or an experienced radio technician for help.

The user is cautioned that changes or modifications made to the equipment or antenna could void the user's authority to operate this equipment.

FCC COMPLIANCE INFORMATION STATEMENT

Trade Name: Cordless Phasing Tester
Model Number: Bierer PD800W

Compliance Test Report Number: B31202D2

Compliance Test Report Dates: 12/01/03 & 12/02/03

Responsible Party: Bierer & Associates, Inc.
Address: 10730 Farrow Rd., Blythewood, SC 29016
Telephone: 803-786-4839

This equipment (Meter Probe) has been tested and found to comply with limits for a Class B, RF Receiver pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular situation. If the unit does cause harmful interference to radio or television, please refer to the three steps listed above under "FCC Instructions to the User".

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PARTS & ACCESSORIES

PART NO.	DESCRIPTION
8128TBALB	15 -25kV Bushing Adapter
8128LHM	Hook Probe Adapter
8128LPM	Straight Probe Adapter
3403	Quick Change to Universal Adapter
3402TH5811	Quick Change to Grip All Adapter
10022CHL	Handle w/Threaded Ferrule and Cap (2 required*)
10022HHSL	Handle w/Threaded Ferrule and Ferrule w/Stud (2 or 4 required*)
PD800ANT	Antenna for Reference or Meter Probe
PD800SH2	Support Hook 2 ft., 51kV to 600kV
PD800SH4	Support Hook 4 ft., above 600kV

*Nominal one inch in diameter and two feet in length; handle assemblies may be two, four or six feet in length.

Limit Mark

All Phasing Meters and Voltage Detectors manufactured after 2007 will have a limit mark engraved on the high voltage probe(s) 2.5 inches from the tip to indicate to the user the physical limit that should not be passed when approaching and contacting an electrical conductor or other electrical test points.



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Hastings Hot Line Tools
Phase-Tell III
Catalog Number 6722



Wireless Phasing Tool
Instruction Manual

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INTRODUCTION

The Phase-Tell III from Hastings is a battery operated two piece wireless phasing tool. A trained utility line crew can use this tool to quickly determine the phase relationship between conductors in a three phase power system. These testers are designed to be attached to an approved hotstick before use. The two Phase-Tell IIIs in this kit are identical. When the Phase-Tell IIIs makes **contact** with an energized phase, both will compare and display an *in phase* or *not in phase* result. The result of the test is displayed using ultra-bright LEDs and an audible horn.



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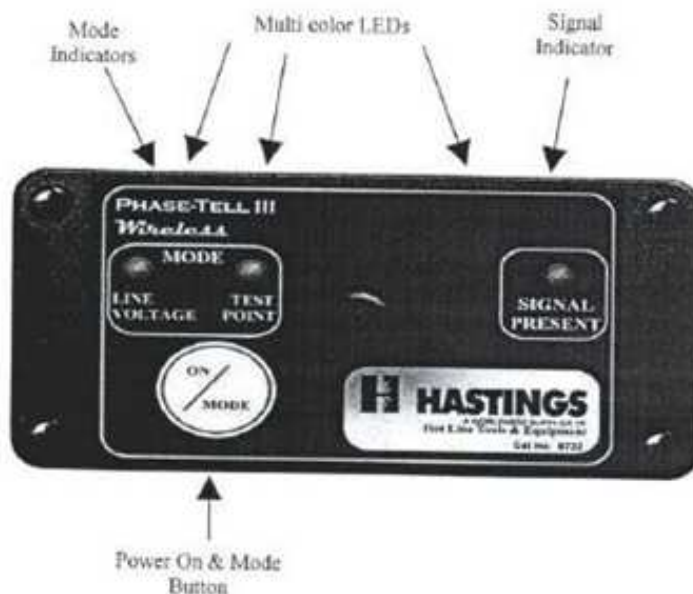
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SAFETY

- The Phase-Tell III system must only be used by trained personnel familiar with the use of such devices in the vicinity of high voltage equipment. The voltages this device is used with are potentially lethal. Improper use may result in serious injury or death.
- Always follow OSHA and company work procedures when using the Phase-Tell III
- Always use the Phase-Tell III with an appropriate hotstick length for the potential being tested.
- Phase-Tell III's startup self test is automatic. If the device does not complete the startup self test do not attempt to use it. (See Page 7 Step 2.0)
- The body of the Phase-Tell III will be at the same potential as the equipment being tested. Use caution when operating the Phases-Tell III in close proximity to grounded surfaces.
- The Phase-Tell III is only intended for operation on 3 phase 60Hz or 50Hz power systems. Do not use in situations where the 2 potentials may not be at the same frequency.
- The Phase-Tell III probes must be in contact with the potential source. Due to the strong fields the device may indicate operation before contact is made but such results may not be accurate.
- The Phase-Tell III must not be used as a voltage indicator

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FEATURES OF THE PHASE-TELL III



Two wireless Phase-Tell IIIs perform a continuous comparison of the phase relationship.

Three multi-color, ultra-bright LEDs indicate status of the unit.

Wide range of operation from elbow test points to 500kv.

Both units report the test result.

Long Battery life from two "AA" batteries

High Quality rugged extruded aluminum enclosure

FCC Certified # Q7V-3F090003X

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OPERATING INSTRUCTIONS

1.0 Prepare to Use

Remove the units from their storage case and inspect for damage.

Attach each Phase Tell to a Hotstick of appropriate length for the voltages to be tested.

2.0 Perform and observe "SELF TEST" result

Press and release the ON/MODE button once to begin self test.

- All LEDs flash BLUE three times. **
- All indicators flash RED three times
- All indicators flash GREEN three times
- All indicators turn on 'multi-color' during battery test*
- The buzzer will sound three times

*If the batteries are low, all indicators will finish the test in yellow.

The unit will still continue to operate following this warning.

The phase test result will be accurate in this condition, however the unit may cease to operate at any time during the test.

** The number of BLUE flashes indicates the radio channel.

The factory default is 3 (See Custom Configuration in Page 11)

3.0 Select Mode of Operation

The flashing Blue LED indicates the active MODE.

LINE VOLTAGE

system line voltage

TEST POINT

URD elbows at the test point

Press and release the ON/MODE button to change modes

Safe Work Practices



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4.0 Contact Phase Tell Probe with the voltage source

When a phase signal is detected, the SIGNAL PRESENT indicator will turn on solid BLUE

When each unit indicates SIGNAL PRESENT, the radios will turn on and establish a wireless link

Maintain contact with the source for 5 seconds to ensure an accurate test.

5.0 Phase Test Result

In Phase: ALL indicators Flashing GREEN

NOT in Phase: ALL indicators flashing RED

RED out of phase results will flash and sound faster than GREEN, in phase results.

6.0 Shutdown

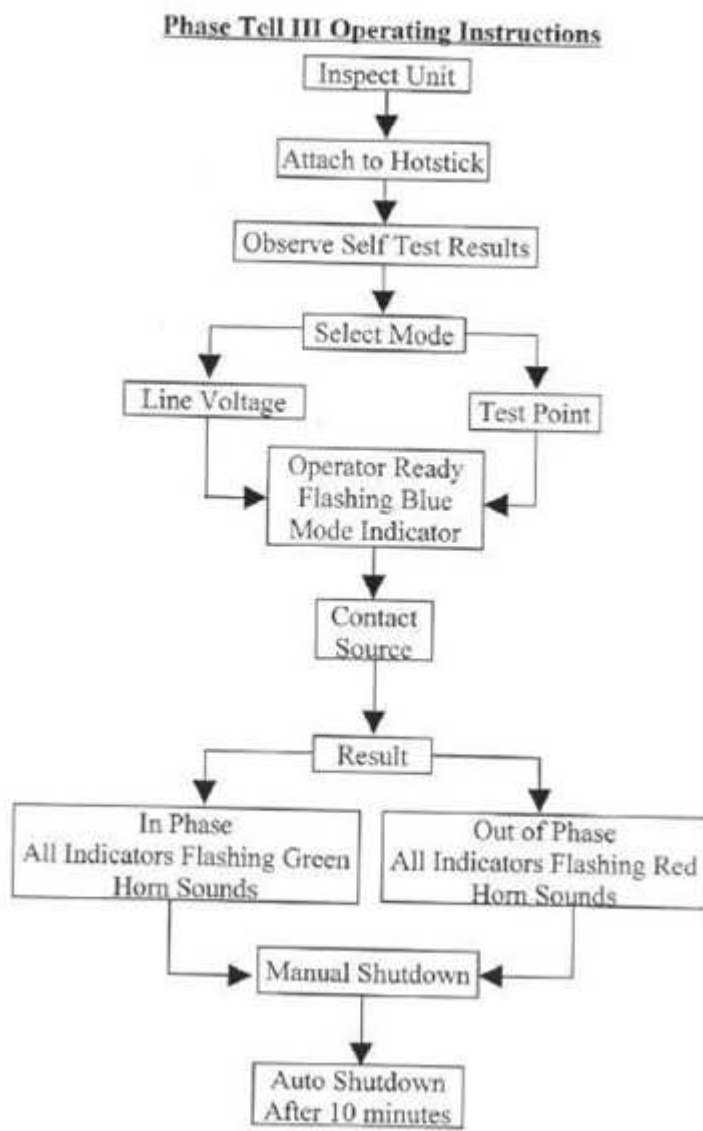
To turn the units off press and hold the ON/MODE pushbutton until the horn begins to sound then release.

Each Phase Tell III will automatically shutdown after 10 minutes if no input signal is detected..

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TROUBLESHOOTING

Two Phase-Tell IIIs sense local signal but fails to communicate.	Verify that the two units are factory configured for the same operating channel. This can be determined by counting the number of BLUE flashes of the LEDs during power-up self test.
Phase-Tell III will not turn on	Check Batteries (if the batteries were installed incorrectly, they will be quickly drained)
A result appears, but the signal present LED is BLUE	The unit is in communications test function. Press the ON/MODE switch to return to operating mode.
The Units indicate a result before making contact	High voltage fields may cause the units to sense and detect the signal before contact is made, this is normal.

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COMMUNICATIONS TEST FUNCTION

This function is provided for radio link testing only.

Phasing cannot be performed when using this function.

To start this test function, DURING self test, press and hold the ON/MODE switch for at least 4 seconds.

At the end of the self test, all the indicators will cycle BLUE indicating that the unit is now in the communication test function.

The SIGNAL PRESENT LED will remain flashing BLUE at all times during communications testing.

During this test each unit will create an internal phase signal. This will cause the two units to operate their radios and establish a communications link.

If a link is made, the mode indicators and buzzer will flash (SIMILAR) to an actual phase test result. This is NOT an indication of phase, and ONLY shows that the radio link is good.

If this result does not happen, the radio link between the two units is not functioning. (See Troubleshooting Section on Page 10)

CUSTOM CONFIGURATIONS

Radio Channel

The Phase-Tell III can be adjusted to operate on different radio 'channels'. It is not recommended that this be changed in the field. Your instrument maintenance department can contact Hastings and receive instructions on how to make these adjustments.

Frequency

The Phase Tell III is factory configured for use on 60hz power systems. For use on 50Hz systems, a simple internal adjustment may be made by your service department.

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BATTERY REPLACEMENT

The Phase-Tell III uses two "AA" cells. These may be either Alkaline or NiMH.

In order to extend battery life, the internal radios will only operate when a voltage signal is detected (SIGNAL PRESENT LED BLUE).

The battery holder is located on the back of the unit near the hook. To replace the batteries remove the cover by turning ¼ turn.



IMPORTANT: Be sure to insert the batteries into the holder negative end first. Failure to do so will drain the batteries.

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SPECIFICATIONS

Operating Distance	Up to 300 feet line of sight depending on conditions
Line Voltage Mode	4kv - 500kv Phase to Phase
Test Point Mode	208V-4800v Phase to Phase
Operating frequency	60Hz (Internal switch to 50Hz)
Phase Discrimination	In phase indication for phase angles difference of < 30°
Batteries	2x 1.5V Alkaline or NiMH "AA"
Radio Frequency	902-928Mhz Band (FCC ID: Q7V-3F090003X)
Radio Power	10mW
Operating Temperature	-40°F to 122°F
Storage Temperature	-40°F to 158°F
Weight	1.8lb (825g)

Safe Work Practices



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WARRANTY

HASTINGS warrants the catalog number 6722 Phase-Tell III to be free from manufacturing defects, for a period of one year from the date of purchase to the original owner. At the discretion of the company, units returned under this warranty shall be either repaired or replaced at no cost to the customer. This warranty will not apply to normal wear and tear or inappropriate use, alteration or abuse of the device.

For warranty or repair send units to:

HASTINGS Hot Line Tools
770 South Cook Road
Hastings, MI 49058

Attn: Warranty Repair Department

For Enquiries or technical assistance call:

269-945-9541 or FAX 269-945-4623

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VOLTMETER/PHASER *and ACCESSORIES*

Operating & Instruction Manual



HDE HD ELECTRIC COMPANY
A Textron Company

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fax 847.473.4981 • website: www.HDElectricCompany.com

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VOLTMETER/PHASER

and ACCESSORIES

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IMPORTANT SAFETY INFORMATION

Read and understand these instructions prior to use. These operating instructions are not a substitute for proper training in the use of this equipment. High voltage systems present serious hazards, including the risk of death or serious injury due to arcing, thermal burns and electrocution. HD Electric's products are intended solely for use by professionals with knowledge, training and experience in the use of the equipment and its accessories in and around high voltage systems.

All applicable federal, state, company and OSHA work practices must be followed. If you are unfamiliar with the work practices required, **DO NOT PROCEED**. Call HD Electric Company if you have any questions regarding this equipment.

**THESE IMPORTANT LABELS ARE AFFIXED TO VARIOUS PRODUCTS.
READ AND UNDERSTAND EACH OF THEM BEFORE PROCEEDING.**



All meters require the use of accessory hotsticks, which may or may not be supplied with the meter. The minimum hotstick length required for safe use depends upon the particular operation; consult federal, state, company and OSHA specifications for the proper hotstick length for the intended operation.

The users of this meter should always be equipped with personal protective equipment including high voltage gloves, flame retardant clothing, eye and face protection. Some applications may require additional protective equipment.

Accessory probes are available for all meters. Always use the proper probe(s) for your application.

Failure to follow these and other warnings and safety precautions may result in severe injury or death.

Safe Work Practices

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GENERAL DESCRIPTION

All HD Electric voltmeters and phasers are constructed with epoxy encapsulated high voltage resistors, a connecting cord and a meter display. The meter display may be digital or analog. The major elements are shown here:



The high voltage resistors limit the current through the connecting cord to a maximum of about one milliamp. Although the connecting cord is insulated for voltage up to 10kV, it should always be kept free and clear from you, ground and any other conductors. These instruments will measure DC through 1000Hz RMS AC.

WARNING: Single stick voltmeters can be used for line-to-ground measurements only. The alligator clip on the end of the coil cord must always be connected to ground prior to making high voltage measurements and should be removed from ground only after high voltage measurements are completed. Two stick voltmeters can be used for both line-to-ground and line-to-line voltage measurements.

WARNING: Some models have range switches or require add-on resistor sticks for higher voltage ranges. Always completely remove the voltmeter from the live circuit before changing the range switch position or adding or removing add-on resistor sticks. Always use add-on resistor sticks in pairs, one on each voltmeter stick.

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MODELS AND SPECIFICATIONS

VOLTMETERS – Analog Meters

LINE-TO-GROUND MEASUREMENTS ONLY

ALL ANALOG MODELS MEASURE DC THROUGH 1000HZ AC.



EM-1 Scale



EM-2 Scale



EM-3 Scale

EM-1 – Single stick, Single range: 0 - 16kV, line-to-ground only

- The alligator clip on the cord must be connected only to ground or system neutral.

EM-2 – Single stick, Single range: 0 - 25kV, line-to-ground only

- The alligator clip on the cord must be connected only to ground or system neutral.

EM-3 – Single stick, Dual range: 0 - 1kV and 0 - 15kV line-to-ground only

- The alligator clip on the cord must be connected only to ground or system neutral.
- Measure on the 1kV scale with the selector switch set for LO range.
- Measure on the 15kV scale with the selector switch set for HI range.

VOLTMETERS & PHASERS – Analog Meters

LINE-TO-GROUND AND LINE-TO-LINE MEASUREMENTS

ALL ANALOG MODELS MEASURE DC THROUGH 1000HZ AC.



Mark I Scale



Mark II Scale



Mark III Scale

MARK I – Dual stick, Single range: 0 - 15kV

MARK II – Dual stick, Dual range: 0 - 15kV and 0 - 45kV

- Measure on the 15kV scale with the selector switch set for LO range.
- Measure on the 45kV scale with the selector switch set for HI range.

MARK III – Dual stick, Dual range: 0 - 15kV & 0 - 75kV with included R-75 add-on resistor sticks

- Measure on the 15kV scale with the selector switch set for LO range and without the add-on resistor sticks.
- Measure on the 75kV scale with the selector switch set for HI range and with the add-on resistor sticks installed, one on each meter stick.

Safe Work Practices

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MODELS AND SPECIFICATIONS *continued*
VOLTMETERS & PHASERS – Analog Meters (continued)



Mark IV Scale



Mark V Scale



Mark VI Scale

MARK IV – Dual stick, Single range: 0 - 5kV

MARK V – Dual stick, Dual range: 0 - 5kV and 0 - 15kV

- Measure on the 5kV scale with the selector switch set for LO range.
- Measure on the 15kV scale with the selector switch set for HI range.

MARK VI – Dual stick, Triple range: 0 - 5kV, 0 - 15kV and 0 - 45kV

with included R-45 add-on resistor sticks

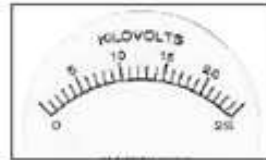
- Measure on the 5kV scale with the selector switch set for LO range and without the add-on resistor sticks.
- Measure on the 15kV scale with the selector switch set for HI range and without the add-on resistor sticks.
- Measure on the 45kV scale with the selector switch set for HI range and with the add-on resistor sticks installed, one on each meter stick.



Mark VII Scale



Mark VIII Scale



Mark IX Scale

MARK VII – Dual stick, Dual range: 0 - 1kV and 0 - 15kV

- Measure on the 1kV scale with the selector switch set for LO range.
- Measure on the 15kV scale with the selector switch set for HI range.

MARK VIII – Single stick/dual stick, Single range: 0 - 15kV

- Can be used for line-to-ground measurements only with single stick and connecting cord with alligator clip. Convert from one stick voltmeter to two stick voltmeter/phaser for both line-to-ground and line-to-line measurements by removing the coil cord with alligator clip and installing cord connected to second resistor stick.

MARK IX – Dual stick, Single range: 0 - 25kV

MARK XI – Dual stick, Dual range: 0 - 5kV and 0 - 25kV

- Measure on the 5kV scale with the selector switch set for LO range.
- Measure on the 25kV scale with the selector switch set for HI range.



Mark XI Scale



Mark XII Scale

MARK XII – Dual stick, Single range: 0 - 40kV

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MODELS AND SPECIFICATIONS *continued*
VOLTMETERS & PHASERS – Digital Meters
DigiVolt Models I, II, III, IV and V

The DVM Models I through V require two 9V lithium or alkaline batteries, which should be replaced at the same time when the battery indication icon (🔋) appears on the display. The DVM I through V have a single button to turn the unit on. This button is pressed again to toggle the backlight on and off. The backlight and meter will shut off automatically after a few minutes, but not while voltage measurements are being made. Some models include a peak hold feature, which is displayed as a blinking decimal point (⋈). The display will hold the maximum voltage reading until it is reset. The meter will not shut-off if it is holding a reading. These models have a large 0.75" LCD display that indicates 3-1/2 digits. All models measure DC through 1000Hz RMS AC.



Front



Back

DVM I – Single stick, Single range: 150V - 19.99kV line-to-ground only

- The alligator clip on the cord must be connected only to ground or system neutral.
 - Includes Peak Hold. Press the Peak Hold button once to activate this feature and once again to clear the reading. A blinking decimal point (⋈) confirms activation of Peak Hold.
- NOTE:** The meter will not shut off while a peak reading is being displayed.

DVM II – Dual stick, Dual range, auto ranging: 150V - 19.99kV and 20.0 - 50.0kV

- Includes Peak Hold. Press the Peak Hold button once to activate this feature and once again to clear the reading. A blinking decimal point (⋈) confirms activation of Peak Hold.
- NOTE:** The meter will not shut off while a peak reading is being displayed.

DVM III – Single stick, Single range: 150V - 19.99kV line-to-ground only

- The alligator clip on the cord must be connected only to ground or system neutral.
 - Includes Peak Hold. Press the Peak Hold button once to activate this feature and once again to clear the reading. A blinking decimal point (⋈) confirms activation of Peak Hold.
- NOTE:** The meter will not shut off while a peak reading is being displayed.
- Includes Test Point Measurement. Press the Test Point button once to activate this feature and once again to shut it off. A display icon (⚡) confirms Test Point mode.

DVM IV – Dual stick, Dual range, auto ranging: 150V - 19.99kV and 20.0 - 50.0kV

- Includes Peak Hold. Press the Peak Hold button once to activate this feature and once again to clear the reading. A blinking decimal point (⋈) confirms activation of Peak Hold.
- NOTE:** The meter will not shut off while a peak reading is being displayed.
- Includes Test Point Measurement. Press the Test Point button once to activate this feature and once again to shut it off. A display icon (⚡) confirms Test Point mode.

DVM V – Dual stick, Single range: 150V - 19.99kV

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MODELS AND SPECIFICATIONS *continued*

VOLTMETER – Digital Meters **DigiVolt Model 25T**



The DVM-25T is a compact, single stick version of the DigiVolt voltmeters. It requires one 9V lithium or alkaline battery, which powers the unit and activates the backlight. The meter will shut off automatically a few minutes after the display reads zero, but not while voltage measurements are being made. The DVM-25T includes an elbow test point reading feature, which is displayed by a blinking decimal point (X). The backlight is always on when the unit is powered on. The low battery feature will simply shut off or will not turn on the meter when the battery is low. The unit has a 0.4" LCD display that indicates 3-1/2 digits. The DVM-25T measures RMS AC and DC.

DVM 25T – Single stick, Dual range, auto ranging:

50V – 19.99kV and 20.0kV – 25.0kV line-to-ground only

- The alligator clip on the cord must be connected only to ground or system neutral.
- Includes Test Point Measurement. Press the ON button again to activate this feature and once again to shut it off. A blinking decimal point (X) confirms Test Point mode.

Safe Work Practices



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OPERATING INSTRUCTIONS

Pre-Use Inspection

WARNING: Before using the instrument be sure to test and inspect the equipment to insure that it is functioning properly and is in safe, working condition. Failure to do so may cause serious injury or death and may result in erroneous test measurements.

Before making any high voltage measurements, test and inspect the voltmeter/phase as follows:

- 1) Make certain the instrument is clean, dry and waxed to a clear shiny surface.
- 2) Inspect the cord for cracked insulation.
- 3) Be sure that you are using hotsticks of the appropriate length, and examine each hotstick to insure that it is clean, dry and waxed to a clear shiny surface.
- 4) Attach the appropriate probes for overhead or underground applications (see page 12 and ensure that the probes are properly installed and tightened (do not overtighten).
- 5) If you are using a multi-range meter, confirm that the range switch is in the proper position.
- 6) Install add-on resistor sticks if necessary for the range being tested.
- 7) Test the voltmeter/phaser with a proof tester such as the HD Electric PT-5000B (see page 12).

Voltage and Phasing Measurements – Line-to-Line

We recommend that two person crews perform all line-to-line voltage measurements and phasing operations. Since the operation is occurring near two energized conductors, the use of two person crews allows each person to operate one meter stick and maintain high safety standards.

In order to make line-to-line measurements, each probe must contact an energized line. Be sure that only those probes intended for the particular application are used (see page 12). Always keep the connecting cord free and clear of energized phases and ground.

For phasing applications, the probes will be placed on opposite sides of an open point, typically a switch. The phasing operation will indicate if two sides of a line are in-phase before closing a switch.

To check all phases proceed as follows:

- 1) Measure voltage on each phase from line-to-ground to verify all phases are live and at the same voltage.
- 2) Place one of the probes on a conductor on one side of the switch.
- 3) Place the other probe on one of the three phases on the other side of the switch.
- 4) If the conductors are out-of-phase, the meter will read line-to-line voltage. If they are in-phase, the meter will read near zero but may read up to 15% of the line-to-line voltage.
- 5) Continue this procedure with all three phases on both sides of the switch.

If an intermediate reading is found, the phasing cannot be determined by this method and the switch should not be closed until other means are used for phasing.

Safe Work Practices



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OPERATING INSTRUCTIONS *continued*

Voltage Measurements – Line-to-Ground

To use a one-stick voltmeter with ground lead, first clip the ground lead on either a ground or system neutral. The resistor stick probe can then be connected to the energized source to be measured. Keep the connecting cord free and clear while testing and disconnect the ground clip only after removing the meter probe from the voltage source.

To use a two-stick voltmeter/phaser, first connect one of the probes to either a ground or system neutral making sure the resistor stick is making contact at all times during measurement. The other probe should be connected to the energized source to be measured.

Maintain contact only long enough to read the meter. Always remove the probe from the energized source first before removing the ground connection.

TEST POINT MEASUREMENTS

Some of the digital voltmeters include a Test Point feature for measuring voltage from elbow test points. On DigiVolt Models DVM III and DVM IV a button on the back of the housing turns this feature on and is shown as (Δ) on the display. To activate Test Point mode on the DVM-25T and DVM-80T simply push the ON button again. Test Point mode is indicated by a blinking decimal point. To turn Test Point mode off, simply push the ON button once again and the decimal point will stop blinking. When using a DigiVolt to phase between test points, the important measurement is whether high voltage is present or not. The proper procedure for phasing between elbow test points is as follows:

- 1) Both elbows must be energized. Follow the proper safety practices for removing the test point protective caps and exposing the live test points. Treat all exposed electrodes as energized high voltage. Measure from both elbow test points to ground. These measurements should show that both elbows are energized and, if both elbows are of the same type and manufacture, should measure the approximate line voltage.
- 2) Measure from one elbow test point to the other. This reading will show either a high voltage reading indicating the elbows are out-of-phase or a zero or low voltage reading indicating the elbows are connected to the same phase. The out-of-phase measurement will likely not show the higher voltage expected from a phase-to-phase measurement but will be closer to the line-to-ground voltage. The in-phase voltage measurement can be between zero and 15% of the nominal line-to-ground voltage. If both elbows are of different type and manufacture, then a higher reading may occur.

CARE AND MAINTENANCE

Periodic regular maintenance is required to keep the voltmeter in proper operating condition. Digital models will require periodic battery replacement. Keep the voltmeter clean and dry and always store it in its case. The fiberglass sticks should be kept clean and free of dirt, contamination and marking. Examine the cord for cracking or other damage prior to each use. Although we don't specify a calibration cycle, we recommend you test, measure and calibrate your instrument annually. The Calibration and Maintenance Log provided on page 15 can be used to record these events. Contact HD Electric Company for details.

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PROBES AND ACCESSORIES

WARNING: ALWAYS use probes appropriate to your application. NEVER use overhead probes in underground applications. Failure to use the correct probe can result in arcing or electrical contact and may cause serious injury or death. If you are not trained in the particular operation or are not sure about the appropriate probe for your application **DO NOT PROCEED.**

Overhead Probes

- OLPS-5 brass hook probe
- OLPS-6 brass pigtail probe



Underground Dead Front Bushing Probes

- ASP-15/25 for use in 15kV and 25kV loadbreak bushings
- ASP-35U for use in 35kV loadbreak bushings

Underground Elbow Probe

- EA-15/25 for insertion in loadbreak elbows.

NOTE: The elbow must be firmly supported when using this probe.

Insulated Underground Probe

- GCP-1 for general underground use on grounded terminals, exposed high voltage terminals or elbow test points.



PROOF TESTER

The PT-5000B Proof Tester will produce 5kVDC at the test leads to confirm proper operation of voltmeters and phasers. This tester should be used only with voltmeters/phasers that measure DC voltage. It will not confirm operation of voltmeters/phasers that measure AC voltage only. The PT-5000B operates from one 9V lithium or alkaline battery and produces approximately 5kVDC at the connecting leads. To use:

- 1) Connect both tester leads to the voltmeter/phaser probes or, for single stick voltmeters, one lead to the probe and one to the alligator clip on the end of the coil cord.
- 2) Press and hold both TEST buttons.
- 3) Confirm a good battery by checking the red light on the Tester. If the red light does not come on, replace the battery with a 9V lithium or alkaline only.
- 4) Verify the voltmeter/phaser reads approximately 5kV.
- 5) Release the TEST buttons and disconnect the Tester from the voltmeter/phaser.



PT-5000B Proof Tester

WARNING: Do not use the voltmeter/phaser if proper operation is not confirmed.

WARNING: Do not use this tester except as directed. Do not use to test equipment other than voltmeters/phasers. Do not apply to energized circuits or equipment. Refer all servicing to the factory. Failure to follow these instructions may lead to electric shock, severe injury or death.

Safe Work Practices

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PROBES AND ACCESSORIES *continued*

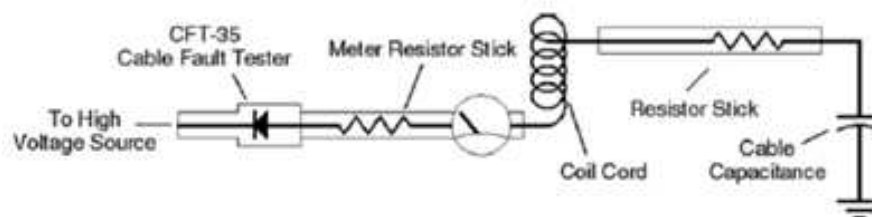
The CFT-35 is for use only with two stick voltmeters for testing leakage current in underground primary voltage cables.



The CFT-35 can be used on underground cables with grounded neutrals with a maximum line-to-ground voltage of 21.1kV or maximum line-to-line voltage of 36.6kV. Operation at higher voltages may damage the CFT-35 and provide erroneous test results.

The CFT-35 is used with a voltmeter/phaser for testing installed or repaired underground cable prior to energizing it. Only cable with extruded dielectric such as rubber or polyethylene can be tested with the CFT-35. Using the CFT-35 on paper insulated cable may provide erroneous test results caused by higher leakage currents typical for this type of cable.

The CFT-35 contains a high voltage rectifier and is connected to test underground primary cable as shown in this circuit:



In practice, the CFT-35 rectifies the high voltage from the source, usually a transformer primary, and charges up the cable, shown as a capacitor above. When a connection is first made, the DC from the CFT-35 will charge up the cable capacitance through the resistors in the meter sticks. If the cable is good, current will stop flowing when the cable is charged up. If the cable is not good, the cable will not charge and current will continue to flow, as indicated by a higher meter indication.

The following equipment is required for testing cable with a CFT-35:

- 1) An HD Electric two-stick voltmeter/phaser.
- 2) The CFT-35 Cable Fault Tester.
- 3) For deadfront applications, ASP bushing probe(s) or, for live front applications, GCP-1 probe(s). An EA-15/25 elbow probe may also be used for deadfront applications.
- 4) For deadfront applications, a feed-through bushing may also be used.

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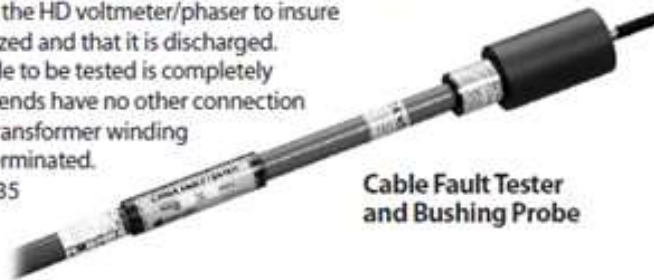
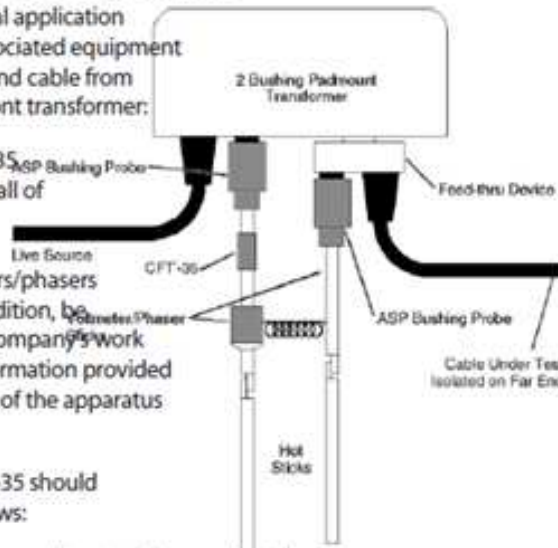
PROBES AND ACCESSORIES *continued*

Shown here is a typical application of the CFT-35 and associated equipment for testing underground cable from a pad-mount dead front transformer:

Before using the CFT-35, read and understand all of the instructions and precautions for live testing with voltmeters/phasers (pages 10 & 11). In addition, be sure to consult your company's work practices and any information provided by the manufacturers of the apparatus that you are testing.

Testing using the CFT-35 should be performed as follows:

- 1) If using a multi-range voltmeter/phaser, select the appropriate range and install add-on resistor sticks if required.
- 2) Test the cable with the HD voltmeter/phaser to insure that it is not energized and that it is discharged.
- 3) Insure that the cable to be tested is completely isolated; that both ends have no other connection to voltage or to a transformer winding and are properly terminated.
- 4) Assemble the CFT-35 with appropriate probe on the voltmeter/phaser stick **with the meter**.
- 5) Assemble the appropriate probe on the voltmeter/phaser stick **without the meter**.
- 6) Connect the voltmeter/phaser stick **without the meter** to the cable to be tested.
- 7) Connect the voltmeter/phaser stick **with the CFT-35** to the voltage source.
- 8) Read the display on the voltmeter/phaser. The reading will be initially high. For example, when testing a 12kV phase-to-phase cable, the line-to-ground voltage is approximately 7.2kV. The rectifier causes HALF that voltage to be displayed on the meter (3.6kV). For a short cable, the reading should return quickly to near zero. For a longer cable, it may take a few seconds for the reading to return to near zero.
- 9) If the reading does not return to near zero after several seconds, the cable is leaking or shorted and the test should be discontinued. Remember that all HD voltmeters/phasers are intermittent duty devices and should be connected only as long as necessary to obtain a reading.
- 10) Discharge the cable by removing the voltmeter/phaser from the line, removing the CFT-35 from the voltmeter/phaser and connecting the voltmeter/phaser from cable to ground.



Cable Fault Tester and Bushing Probe

Safe Work Practices



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LIMITED WARRANTY AND LIMITATION OF LIABILITY

This warranty applies to all products sold by HD Electric Company (the "Products"), provided, however, that the term Products does not include any third party products purchased through HD Electric Company, for which no warranties are made (the "Third Party Products"). Third Party Products may be subject to a separate manufacturer's warranty. (Should you have any question regarding whether a separate warranty applies, please contact HD Electric Company).

NOTICE: READ THIS LIMITATION OF WARRANTY AND LIABILITY BEFORE BUYING OR USING THE PRODUCTS CONTAINED HEREIN.

It is impossible to eliminate all risks associated with the use of the Products. Risks of serious injury or death, including risks associated with electrocution, arc and thermal burns, are inherent in work in and around energized electrical systems. Such risks arise from the wide variety of electrical systems and equipment to which Products 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 HD Electric Company.

HD Electric Company does not agree to be an insurer of these risks, and shall have no liability for any claims arising from such risks.

WHEN YOU BUY OR USE THESE PRODUCTS, YOU AGREE TO ACCEPT THESE RISKS.

HD Electric Company warrants to the original purchaser that the Products (including any third party products purchased through HD Electric Company, for which no warranties are made) will be free from defects in material and workmanship, under normal use and regular service, and preventative maintenance for a period of one (1) year (ten (10) years for HDE Capacitor Controls) from the date of shipment (the "Warranty Period"). Should any failure to conform with this warranty be found during the Warranty Period, you must notify HD Electric Company of your claim within thirty (30) days of discovery, and within the Warranty Period. Your failure to give notice of claims of breach of warranty within the Warranty Period shall be deemed an absolute and unconditional waiver of claims for such defects. HD Electric Company will have no responsibility to honor claims received after the date the applicable Warranty Period expires.

Upon notice of your claim, HD Electric Company will provide a return authorization number, and further instructions on how to return the product for service. You must follow HD Electric Company's instruction. You are responsible for all Product removal, handling, re-installation, and shipping (both to and from HD Electric Company). Products returned for repair, as well as repaired or replacement Products shall be sent postage / freight prepaid. After receipt of a product which HD Electric Company determines is defective, HD Electric will, at its option, either (1) repair (or authorize the repair of) the Product or (2) replace the Product, subject to the following: The Products are made using parts sourced from a variety of manufacturers. Due to the rapidly changing technology environment, parts may become obsolete / unavailable over time (end of life). In the event that a Product cannot be repaired or replaced due to unavailability of parts, HD Electric Company will use commercially reasonable efforts to obtain substitute parts or conduct work around design, but cannot guarantee its ability to do so.

Items not found defective will be returned at your expense, or failing receipt of instruction from you on return of such items within five (5) business days of our notice to you that the product is not defective, HD Electric may dispose of the product at its discretion and with no liability to you. HD Electric Company's determination of defects is final. Products repaired or replaced during the Warranty Period shall be covered by the foregoing warranties for the remainder of the original Warranty Period or ninety (90) days from the date of delivery of the repaired or replaced Products, whichever is longer.

LIMITATIONS:

This warranty is void in the event of misuse, alteration, faulty installation, or misapplication of the product.

This warranty does not cover failure of product or components due to any ACT OF NATURE, lightning, floods, hurricanes, tornadoes or any other such catastrophic events.

HD Electric Company does not warrant any third party products or associated hardware or their performance or suitability for use and application. Such items are provided "as-is".

All repairs must be authorized by HD Electric Company. Unauthorized repairs will not be reimbursed under any circumstances.

HD Electric Company is not required to make replacement or loaner equipment available while Products are being repaired or replaced, or to compensate you for any in-out labor charges or expenses associated with removal, handling or re-installation of the Products.

TO THE MAXIMUM EXTENT PERMITTED BY LAW, THIS WARRANTY AND THE REMEDIES SET FORTH ABOVE ARE EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES, REMEDIES AND CONDITIONS, WHETHER ORAL OR WRITTEN, EXPRESS OR IMPLIED. HD ELECTRIC EXPRESSLY DISCLAIMS ALL OTHER WARRANTIES OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION IMPLIED WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE, MERCHANTABILITY AND NON-INFRINGEMENT.

IN NO EVENT SHALL HD ELECTRIC COMPANY BE LIABLE FOR ANY INDIRECT, INCIDENTAL, CONSEQUENTIAL, OR SPECIAL DAMAGES RESULTING FROM THE USE OR HANDLING OF THESE PRODUCTS. THIS SHALL INCLUDE BUT, NOT LIMITED TO, LOST PROFITS OR REVENUE, LOSS OF USE OF THE PRODUCTS, COST OF SUBSTITUTE PRODUCTS, FACILITIES OR SERVICES, OR DOWNTIME.

IN NO EVENT SHALL HD ELECTRIC COMPANY HAVE ANY LIABILITY FOR ANY THIRD PARTY PRODUCTS OR ASSOCIATED HARDWARE, OR CUSTOMER-OWNED SYSTEMS, EQUIPMENT OR SOFTWARE.

HD Electric Company must have prompt notice of any claim so that an immediate product inspection and investigation can be made. Buyer and all users shall promptly notify HD Electric Company of any claims, whether based on contract, negligence, strict liability, or other tort or otherwise be barred from any remedy.

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.

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Safe Work Practices



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DVM-80UVM VOLTMETER/PHASER and ACCESSORIES



Operating
and
Instruction
CE Manual

HDE HD ELECTRIC COMPANY
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VOLTMETER/PHASER
DVM80UVM
and ACCESSORIES
Operating & Instruction Manual

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IMPORTANT SAFETY INFORMATION

Read and understand these instructions prior to use. These operating instructions are not a substitute for proper training in the use of this equipment. High voltage systems present serious hazards, including the risk of death or serious injury due to arcing, thermal burns and electrocution. HD Electric Company products are intended solely for use by professionals with knowledge, training and experience in the use of the equipment and its accessories in and around high voltage systems.

All applicable federal, state, company and OSHA work practices must be followed. If you are unfamiliar with the work practices required, **DO NOT PROCEED**. Call HD Electric Company if you have any questions regarding this equipment. These important labels are affixed to the product. Read and understand each label before proceeding.

**THESE IMPORTANT LABELS ARE AFFIXED TO THE PRODUCT.
READ AND UNDERSTAND EACH OF THEM BEFORE PROCEEDING.**



All meters require the use of accessory hotsticks, which may or may not be supplied with the meter. The minimum hotstick length required for safe use depends upon the particular operation; consult federal, state, company and OSHA specifications for the proper hotstick length for the intended operation.

The users of this meter should always be equipped with personal protective equipment including high voltage gloves, flame retardant clothing, eye and face protection. Some applications may require additional protective equipment.

Accessory probes are available for all meters. Always use the proper probe(s) for your application.

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

Failure to follow these and other warnings and safety precautions may result in severe injury or death.

Safe Work Practices

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GENERAL DESCRIPTION

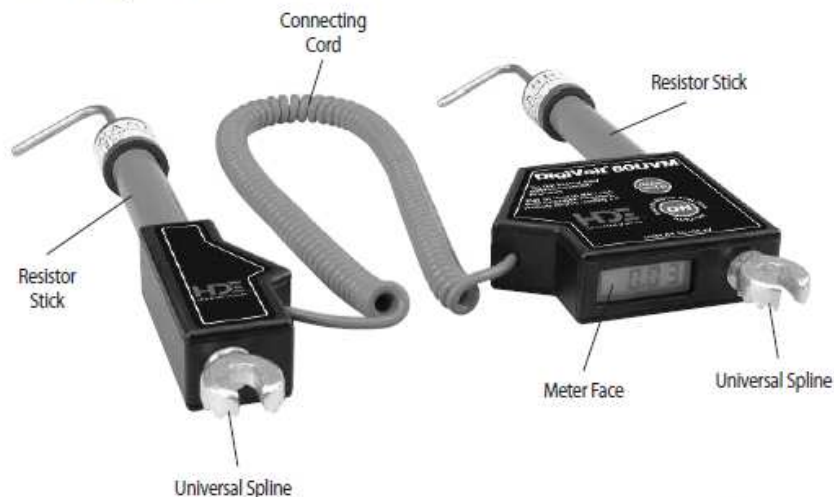
The DVM-80UVM is a high accuracy digital voltmeter and phasing set designed to measure voltages up to 40kV and up to 80kV when used with a pair of add-on resistors. The DVM-80UVM includes an elbow test point reading feature as well as a peak hold feature. The DVM-80UVM can be purchased on its own or in a complete, ready-to-use Universal Voltmeter Kit that contains the following probes and accessories:

DVM-80UVK UNIVERSAL VOLTMETER KIT

- Dual stick phasing voltmeter (DVM-80UVM)
- Two overhead hook probes (025-OLPS-5)
- Two resistor sticks for measurements up to 80kV (R-80)
- Two underground bushing probes, 15 and 25kV class (ASP-15/25)
- An underground cable fault tester, 15, 25 and 35kV class (CFT-35)
- Voltmeter proof tester (PT-5000B)
- Two shotgun hotstick adapters (HSA-2500)
- A soft-sided, multi-functional carrying bag (B-12)

See pages 9-14 for a complete list of probes and accessories available.

All HD Electric voltmeters and phasers are constructed with epoxy encapsulated high voltage resistors, a connecting cord and a meter display. The DVM-80UVM is a digital meter. The major elements are shown here:



The high voltage resistors limit the current through the connecting cord to less than one milliamp. Although the connecting cord is insulated for voltage up to 10kV, it should always be kept free and clear from you, ground and any other conductors. These instruments will measure DC through 1000Hz RMS AC.

WARNING: The DVM-80UVM will require add-on resistor sticks for higher voltage ranges. Always completely remove the voltmeter from the live circuit before adding or removing add-on resistor sticks. Always use add-on resistor sticks in pairs, one on each voltmeter stick.

Safe Work Practices

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TECHNICAL SPECIFICATIONS



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** - 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.
- **Overtoltage Category IV**
- **Enclosure Material** - PVC UL 94-V0, fiberglass
- **Printed Circuit Boards** - FR-4 UL94V-0

BATTERY REPLACEMENT INSTRUCTIONS

To replace the battery, open and remove the compartment on the rear of the meter housing. Remove and dispose of the old battery, replacing it with a fresh, new 9-volt lithium or alkaline battery. Note battery polarity on the battery compartment. This compartment cannot be reinserted if the battery polarity is reversed.

MANUFACTURING LOCATION

HD Electric Company • Waukegan, IL. 60085, USA

DIMENSIONS:

- **Length (w/o probes)** - 15"(38cm)
- **Display Housing** - 5"W x 4.25"L x 1.38"H (13cm x 11cm x 3.5cm)
- **Diameter of Fiberglass** - 1"(2.54cm)
- **Connecting Cord Length** - 12'(3.6m) fully extended, 3.5'(1.7m) retracted
- **Weight** - (w/o probes): 2.25 lbs. (1.02kg)
- **LCD Numeral Height** - 0.4", indicates 3.5 digits
- **Battery Life** - 17 hours continuous use
- **Battery** - 9V alkaline 1604A, IEC 6LR61 or 9V lithium, ANSI-1604LC.
- **Digital Meter** - Reads in kilovolts, 3.5 digits with decimal point
- **Voltage Range** - 5V-40kV, up to 80kV with add-on resistors, DC, AC 25-1000Hz
- **Auto-Ranging** - No range selector switch
- **Accuracy**
 - Within 1% of reading +/- 3 counts
 - With R-80 add-on resistors installed - within 2% of reading +/- 3 counts (line-to-ground & line-to-line measurements)
- **Meter Resolution**
 - 0.005 - 1.999 range with 1 Volt resolution
 - 2.00 - 19.00 range with 10 Volt resolution
 - 19.0 - 40.0 range with 100 Volt resolution

Safe Work Practices



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OPERATING INSTRUCTIONS

The DVM-80UVM requires one 9V lithium or alkaline battery, which powers the unit and activates the backlight. The meter will shut off automatically a few minutes after the display reads zero, but not while voltage measurements are being made. The DVM-80UVM includes an elbow test point reading feature, which is displayed by a blinking decimal point (.) and a Peak Hold feature which is indicated by all decimal points flashing.

To activate the Peak Hold feature, press the Peak Hold button. The display will hold the highest reading while Peak Hold is activated. To deactivate the Peak Hold and clear the display, press the Peak Hold button again.

NOTE: The meter will not shut off while a peak reading is displayed.

The backlight is always on when the unit is powered on. The low battery feature will simply shut off or will not turn on the meter when the battery is low. The unit has a 0.4" LCD display that indicates 3-1/2 digits. The DVM-80UVM measures RMS AC and DC.

The DVM-80UVM is autoranging with three ranges. The lowest range is from .005kV (5V) to 1.999kV. The middle range is from 2.00kV to 19.99kV and the highest range is from 20.0kV to 40.0kV.

To take readings above 40.0kV, attach one R-80 on each meter stick, and then multiply the reading on the display by two (for example, if the display reads 30kV with add-on resistor sticks installed, multiply 30 times 2 = 60.0kV). Do not exceed 80kV with the R-80 resistor sticks attached.

PRE-USE INSPECTION

WARNING: Before using the instrument be sure to test and inspect the equipment to insure that it is functioning properly and is in safe, working condition. Failure to do so may cause serious injury or death and may result in erroneous test measurements.

Before making any high voltage measurements, test and inspect the voltmeter/phaser as follows:

- 1) Make certain the instrument is clean, dry and waxed to a clear shiny surface.
- 2) Inspect the cord for cracked insulation.
- 3) Be sure that you are using hotsticks of the appropriate length, and examine each hotstick to insure that it is clean, dry and waxed to a clear shiny surface.
- 4) Attach the appropriate probes for overhead or underground applications (see page 9) and ensure that the probes are properly installed and tightened (do not overtighten).
- 5) Install add-on resistor sticks if necessary for the range being tested.
- 6) Test the voltmeter/phaser with a proof tester such as the HD Electric PT-5000B Proof Tester Voltmeter Tester (see page 10).

VOLTAGE AND PHASING MEASUREMENTS – LINE-TO-LINE

We recommend that two person crews perform all line-to-line voltage measurements and phasing operations. Since the operation is occurring near two energized conductors,

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OPERATING INSTRUCTIONS *continued*

the use of two person crews allows each person to operate one meter stick and maintain high safety standards.

In order to make line-to-line measurements, each probe must contact an energized line. Be sure that only those probes intended for the particular application are used (see page 9). Always keep the connecting cord free and clear of energized phases and ground.

For phasing applications, the probes will be placed on opposite sides of an open point, typically a switch. The phasing operation will indicate if two sides of a line are in-phase before closing a switch.

To check all phases proceed as follows:

- 1) Measure voltage on each phase from line-to-ground to verify all phases are live and at the same voltage.
- 2) Place one of the probes on a conductor on one side of the switch.
- 3) Place the other probe on one of the three phases on the other side of the switch.
- 4) If the conductors are out-of-phase, the meter will read line-to-line voltage. If they are in-phase, the meter will read near zero but may read up to 15% of the line-to-line voltage.
- 5) Continue this procedure with all three phases on both sides of the switch.

If an intermediate reading is found, the phasing cannot be determined by this method and the switch should not be closed until other means are used for phasing.

VOLTAGE MEASUREMENTS – Line-to-Ground

Keep the connecting cord free and clear while testing.

To use this two-stick voltmeter/phaser, first connect one of the probes to either a ground or system neutral making sure the resistor stick is making contact at all times during measurement. The other probe should be connected to the energized source to be measured.

Maintain contact only long enough to read the meter. Always remove the probe from the energized source first before removing the ground connection.

TEST POINT MEASUREMENTS

The DVM-80UVM includes a Test Point feature for measuring voltage from elbow test points. To activate Test Point mode simply push the ON button again. Test Point mode is indicated by a blinking decimal point. To turn Test Point mode off, simply push the ON button once again and the decimal point will stop blinking. When using a voltmeter/phasing set to phase between test points, the important measurement is whether high voltage is present or not. The proper procedure for phasing between elbow test points is as follows:

- 1) Both elbows must be energized. Follow the proper safety practices for removing the test point protective caps and exposing the live test points. Treat all exposed electrodes as energized high voltage. Measure from both elbow test points to ground. These measurements should show that both elbows are energized and, if both elbows are of the same type and manufacture, should measure the approximate line voltage.

Safe Work Practices



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- 2) Measure from one elbow test point to the other. This reading will show either a high voltage reading indicating the elbows are out-of-phase or a zero or low voltage reading indicating the elbows are connected to the same phase. **The out-of-phase measurement will likely not show the higher voltage expected from a phase-to-phase measurement but will be closer to the line-to-ground voltage. The in-phase voltage measurement can be between zero and 15% of the nominal line-to-ground voltage.** If both elbows are of different type and manufacture, then a higher reading may occur.

PEAK HOLD

The DVM-80UVM includes a Peak Hold feature. To activate the Peak Hold feature press the Peak Hold button. Peak Hold is indicated by all decimal points flashing. The display will hold the highest reading while Peak Hold is activated. To deactivate the Peak Hold and clear the display, press the Peak Hold button again.

Note: The meter will not shut off while a peak reading is displayed.

CARE AND MAINTENANCE

Periodic regular maintenance is required to keep the voltmeter in proper operating condition. Keep the voltmeter clean and dry and always store it in its case. The fiberglass sticks should be kept clean and free of dirt, contamination and marking. Examine the cord for cracking or other damage prior to each use. Although we don't specify a calibration cycle, we recommend you test, measure and calibrate your instrument annually. The Calibration and Maintenance Log provided on page 15 can be used to record these events. Contact HD Electric Company for details.

CLEANING INSTRUCTIONS: To clean the DVM wipe with a damp cloth with water. Do not use harsh chemicals or solvents.

PROBES AND ACCESSORIES

WARNING: ALWAYS use probes appropriate to your application. NEVER use overhead probes in underground applications. Failure to use the correct probe can result in arcing or electrical contact and may cause serious injury or death. If you are not trained in the particular operation or are not sure about the appropriate probe for your application **DO NOT PROCEED.**

The DVM-80UVM comes standard with two overhead hook probes (025-OLPS-5), a 9-volt battery, instruction manual and a carrying case (CS-DVM). The DVM-80UVK Universal Voltmeter Kit is supplied with a DVM-80UVM dual stick phasing voltmeter, two overhead hook probes (025-OLPS-5), two resistor sticks (R-80), two underground bushing probes (ASP-15/25), an underground cable fault tester (CFT-35), voltmeter proof tester (PT-5000B), two shotgun hotstick adapters (HSA-2500), a 9-volt battery, instruction manual and a soft-sided carrying bag (B-12). The following pages show descriptions of these as well as other optional probes and accessories available.

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PROBES AND ACCESSORIES *continued*

OVERHEAD PROBES

- 025-OLPS-5 brass hook probe
- 025-OLPS-6 brass pigtail probe



UNDERGROUND DEAD FRONT BUSHING PROBES

- ASP-15/25 for use in 15kV and 25kV loadbreak bushings
- ASP-35U for use in 35kV loadbreak bushings

UNDERGROUND ELBOW PROBE

EA-15/25 for insertion in loadbreak elbows
 NOTE: The elbow must be firmly supported when using this probe



INSULATED UNDERGROUND PROBE

GCP-1 for general underground use on grounded terminals, exposed high voltage terminals or elbow test points.

ADD-ON RESISTOR STICK

R-80 used to take readings above 40kV. Always completely remove the voltmeter from the live circuit before adding or removing add-on resistor sticks. Always use the add-on resistor sticks in pairs, one on each voltmeter stick, then attach the appropriate overhead or underground probe to be used. When a reading is displayed, multiply that reading by two (for example, if the display reads 30kV with add-on resistor sticks installed, multiply 30 times 2 = 60kV). Do not exceed 80kV with the R-80 resistor sticks attached.



HOTSTICK

A range of hotsticks are available in lengths starting at 4'. Contact HD Electric for more details.

HOTSTICK ADAPTER

HSA-2500 shotgun hotstick adapter

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PROBES AND ACCESSORIES *continued*

PROOF TESTER® VOLTMETER TESTER

The PT-5000B Proof Tester Voltmeter Tester will produce 5kVDC at the test leads to confirm proper operation of voltmeters and phasers. This tester should be used only with voltmeters/phasers that measure DC voltage. It will not confirm operation of voltmeters/phasers that measure AC voltage only. The PT-5000B operates from one 9V lithium or alkaline battery and produces approximately 5kVDC at the connecting leads. To use:

- 1) Connect both tester leads to the voltmeter/ phaser probes.
- 2) Press and hold both TEST buttons.
- 3) Confirm a good battery by checking the red light on the Tester. If the red light does not come on, replace the battery with a 9V lithium or alkaline only.
- 4) Verify the voltmeter/phaser reads approximately 5kV.
- 5) Release the TEST buttons and disconnect the Tester from the voltmeter/phaser.



**PT-5000B Proof Tester
Voltmeter Tester**

WARNING: Do not use the voltmeter/phaser if proper operation is not confirmed.

WARNING: Do not use this tester except as directed. Do not use to test equipment other than voltmeters/phasers. Do not apply to energized circuits or equipment. Refer all servicing to the factory. Failure to follow these instructions may lead to electric shock, severe injury or death.

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PROBES AND ACCESSORIES *continued*

CABLE FAULT TESTER

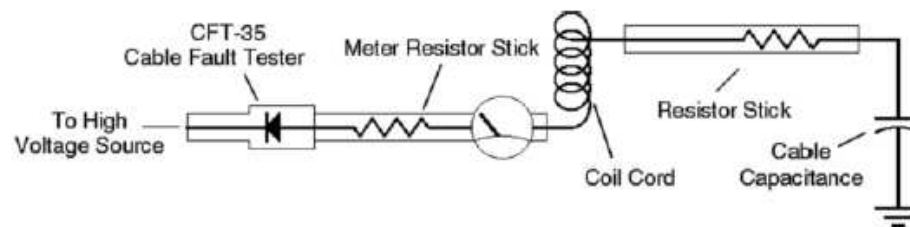
The CFT-35 is for use only with two stick voltmeters for testing leakage current in underground primary voltage cables.



The CFT-35 can be used on underground cables with grounded neutrals with a maximum line-to-ground voltage of 21.1kV or maximum line-to-line voltage of 36.6kV. Operation at higher voltages may damage the CFT-35 and provide erroneous test results.

The CFT-35 is used with a voltmeter/phaser for testing installed or repaired underground cable prior to energizing it. Only cable with extruded dielectric such as rubber or polyethylene can be tested with the CFT-35. Using the CFT-35 on paper insulated cable may provide erroneous test results caused by higher leakage currents typical for this type of cable.

The CFT-35 contains a high voltage rectifier and is connected to test underground primary cable as shown in this circuit:



In practice, the CFT-35 rectifies the high voltage from the source, usually a transformer primary, and charges up the cable, shown as a capacitor above. When a connection is first made, the DC from the CFT-35 will charge up the cable capacitance through the resistors in the meter sticks. If the cable is good, current will stop flowing when the cable is charged up. If the cable is not good, the cable will not charge and current will continue to flow, as indicated by a higher meter indication.

The following equipment is required for testing cable with a CFT-35:

- 1) An HD Electric two-stick voltmeter/phaser.
- 2) The CFT-35 Cable Fault Tester.
- 3) For deadfront applications, ASP bushing probe(s) or, for live front applications, GCP-1 probe(s). An EA-15/25 elbow probe may also be used for deadfront applications.
- 4) For deadfront applications, a feed-through bushing may also be used.

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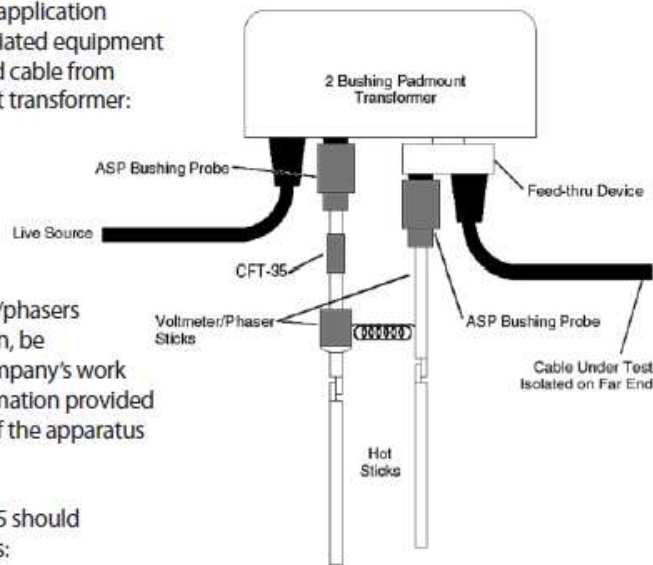
PROBES AND ACCESSORIES *continued*

Shown here is a typical application of the CFT-35 and associated equipment for testing underground cable from a pad-mount dead front transformer:

Before using the CFT-35, read and understand all of the instructions and precautions for live testing with voltmeters/phasers (pages 7 & 8). In addition, be sure to consult your company's work practices and any information provided by the manufacturers of the apparatus that you are testing.

Testing using the CFT-35 should be performed as follows:

- 1) Test the cable with the HDE voltmeter/phaser to insure that it is not energized and that it is discharged.
- 2) Insure that the cable to be tested is completely isolated; that both ends have no other connection to voltage or to a transformer winding and are properly terminated.
- 3) Assemble the CFT-35 with appropriate probe on the voltmeter/phaser stick **with the meter**.
- 4) Assemble the appropriate probe on the voltmeter/phaser stick **without the meter**.
- 5) Connect the voltmeter/phaser stick **without the meter** to the cable to be tested.
- 5) Connect the voltmeter/phaser stick **with the CFT-35** to the voltage source.
- 6) Read the display on the voltmeter/phaser. The reading will be initially high. For a short cable, the reading should return quickly to near zero. For a longer cable, it may take a few seconds for the reading to return to near zero.
- 8) If the reading does not return to near zero after several seconds, the cable is leaking or shorted and the test should be discontinued. Remember that all HDE voltmeters/phasers are intermittent duty devices and should be connected only as long as necessary to obtain a reading.
- 9) Discharge the cable by removing the voltmeter/phaser from the line, removing the CFT-35 from the voltmeter/phaser and connecting the voltmeter/phaser from cable to ground.



Cable Fault Tester and Bushing Probe

Safe Work Practices



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PROBES AND ACCESSORIES *continued*

With the DVM-80UVM, if the cable is completely shorted the meter will read the line voltage times 0.71. For a nominal 7.2kV circuit the meter will read approximately 5.1kV.

Listed here are the actual cable leakage currents for voltage readings on the DVM-80UVM digital meter:

- Meter reading of 0.5kV = 8uA
- Meter reading of 1.0kV = 16uA
- Meter reading of 2.0kV = 31uA

REPAIRS

All repairs and calibration are performed at HD Electric Company. If any damage is found please contact HD Electric Company at 847-473-4980 to arrange for service.

Safe Work Practices



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This warranty applies to all products sold by HD Electric Company (the "Products"); provided, however, that the term Products does not include any third party products purchased through HD Electric Company, for which no warranties are made (the "Third Party Products"). Third Party Products may be subject to a separate manufacturer's warranty; [should you have any question regarding whether a separate warranty applies, please contact HD Electric Company].

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It is impossible to eliminate all risks associated with the use of the Products. Risks of serious injury or death, including risks associated with electrocution, arcing and thermal burns, are inherent in work in and around energized electrical systems. Such risks arise from the wide variety of electrical systems and equipment to which Products 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 HD Electric Company.

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This warranty does not cover failure of product or components due to any ACT OF NATURE; lightning, floods, hurricanes, tornadoes or any other such catastrophic events.

HD Electric Company does not warrant any third party products or associated hardware or their performance or suitability for use and application. Such items are provided "as-is".

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