PosiTest® *HHDC*

High voltage Holiday Detector

Instruction Manual

DeFelsko®
The Measure of Quality

Introduction

The **PosiTest *HHD C* High voltage Holiday Detector** is a Continuous DC Holiday Detector designed to locate defects and discontinuities (called "pinholes" or "holidays") in a coating system applied to a conductive substrate. High voltage holiday detectors are commonly used to inspect non-conductive coatings thicker than 500 μm (20 mils).

Designed for maximum utility, the powerful Li-on batteries of the **PosiTest *HHD C*** fit neatly within the wand handle eliminating the need for a separate battery box—reducing weight and eliminating operator fatigue.

Operational Safety

IMPORTANT: DeFelsko recommends that the operator read and fully understand this manual prior to using the **PosiTest *HHD C***.

WARNING: ⚠️⚠️ This equipment generates high voltages up to 30,000V (30kV). Accidental contact with the electrode may result in an electric shock. Always keep the working end of the electrode away from your body and never touch it when activated. The **PosiTest *HHD C*** operator should exercise care to minimize their risk of electric shock and be aware of all relevant safety guidelines before using this equipment.

The ribbed end of the instrument is designed to maximize the distance between the electrode collar and the operator. The electrode and ribbed end of the instrument should not be touched when the **PosiTest *HHD C*** is in **Detection Mode**.

When in **Detection Mode** (pg. 4) generating high voltage or if an arc is being produced, the **PosiTest *HHD C*** will generate broadband Radio Frequency emissions. Care must be observed in the vicinity of sensitive electronics or radio equipment.

NOTE: The **PosiTest *HHD C*** includes a built-in bleeder resistor, which will discharge the surface when the electrode is in contact with the part AND the tester is not generating high voltage.

For safe **PosiTest *HHD C*** operation:

DO NOT —

- Use in wet or rainy conditions.
- Use if you are fitted with a pacemaker.
- Use without first connecting the ground (earth) cable.
- Touch or allow anyone else to touch the object being tested.
- Use in any environment where an arc or spark could result in explosion.

DO —

- Ensure that all connections are secure and tight.
- Wear appropriate gloves and footwear.
- Use flagging tape and signage to keep other personnel away from the testing area.
- Communicate the hazards associated with holiday testing with all personnel on-site via tailgate meetings or Field Level Hazard Assessments.
- Power OFF the detector before touching the spring or brush.
- Confirm the testing voltage requirements and ensure this is communicated to all personnel involved or working in the area.
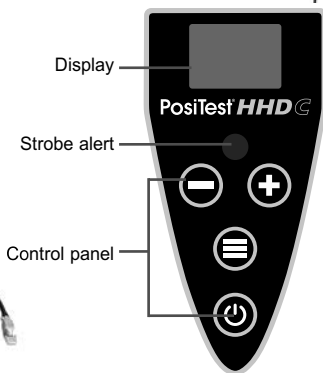
PosiTest *HHD C* Overview
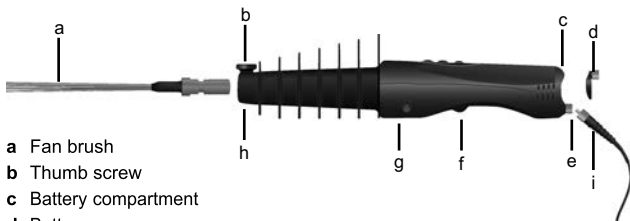
a Fan brush
b Thumb screw
c Battery compartment
d Battery cover
e Ground cable socket with nut
f Trigger
g Speaker
h Electrode collar
i Ground cable

Not shown
Hard shell case
Batteries

Display

Strobe alert

Control panel

The **PosiTest *HHD C* Kit** contains the following materials.

A **PosiTest *HHD C***
B Stainless Steel Fan Brush
C 7.6 m (25') Ground (earth) cable with Ground Clip
D 4 Li-ion 18650 Cell Batteries
E Smart Battery charger with universal AC voltage input
     Hard shell case (not shown)

 Accessories

A variety of optional and replacement accessories are available to help you get the most out of your **PosiTest *HHD C***.
See www.defelsko.com/hhd to learn more.

Quick Start

The **PosiTest *HHD C*** powers-up when the power button ⏻ is pressed. To preserve battery life, it powers down after approximately 5 minutes of no activity. Alternatively, hold the power button ⏻ for 5 seconds for immediate power down. All settings are retained.

1. Review **Operational Safety** (pg. 1).

2. Assemble the detector for the application to be tested – **"Assembly Instructions"** (pg. 5).

3. Properly ground the instrument – **"Grounding"** (pg. 5).

4. Confirm that the detector is in proper working condition – **"Operational Check"** (pg. 5).

5. Verify and Set the test voltage and sensitivity – "**Adjusting the Test Voltage and Sensitivity**" (pg. 6).

6. Perform the test – **"Instrument Operation"** (pg. 7).

The **PosiTest *HHD C*** has two primary operating modes:

1. **Standby Mode:** The detector is powered up but not generating a high voltage. The detector continuously monitors the electrode voltage, and will display the voltage and lightning bolt icon ⚡ if voltages over 500 Volts are present on the electrode. DO NOT touch the electrode or surface if the lightning bolt icon ⚡ is shown on the display.

2. **Detection Mode:** The detector is generating a high voltage and analyzing electrode voltage and current to determine if holidays are present. Holidays can be detected when the charged electrode is passed over a coated substrate. When a holiday is encountered, current flows from the electrode into the substrate. The current returns to the detector through the ground (earth) wire, completing the circuit and triggering audible and visible alarms. An integrated voltmeter measures and displays the electrode voltage on the display while in use.

   After the trigger is released the detector returns to Standby Mode. The electrode voltage and lightning bolt icon will continue to be displayed until the electrode and surface have discharged. DO NOT touch the electrode or surface if the lightning bolt ⚡ is shown on the display.

Assembly Instructions

STEP 1. Attach the Electrode: Loosen the thumb screw on the electrode collar, or if using an electrode rod, loosen the thumb screw on the free end of the electrode rod. Attach the required electrode and re-tighten the thumb screw.

STEP 2. Attach the Ground Cable: Insert the included ground cable into the ground socket and finger tighten the nut by turning clockwise.

STEP 3. Install the Batteries: Loosen the screw on the battery cover door, and remove the cover. Install the batteries in the correct orientation, as indicated on the inside of the battery cover. Replace the cover and secure with the thumb screw.

Grounding

Ensure the ground (earth) cable is uncoiled and fully extended. Connect the ground clip to an exposed (uncoated) area of the part. A direct conductive path must be established between the **PosiTest HHD C** and the conductive substrate of the part being tested.

WARNING:

Never touch the ground cable while the detector is in use.

Operational Check

Prior to each use, the **PosiTest HHD C** should be checked to ensure it is operating correctly. This operational check ensures that the audible and visual alerts are operating properly and the instrument is generating a voltage. For **Calibration and Verification** see pg. 9.

Performing an Operational Check

1. Ensure the instrument and all components are assembled.

2. Visually inspect each cable and connection.

3. Press and release the power button ⏻ on the top of the **PosiTest HHD C**.

4. The **PosiTest HHD C** should power on and display the test voltage.

5. Press and hold the trigger on the **PosiTest HHD C** to turn on the high voltage and activate Detection Mode.

6. Touch the electrode to the bare ground wire or grounded substrate of the part being inspected.

7. The **PosiTest *HHD C*** audible and strobe alerts should activate.

NOTE: A spark may or may not be seen and heard. When using a lower test voltage or in bright conditions, the spark may not be visible.

8. Release the trigger to turn high voltage OFF and return the **PosiTest *HHD C*** to **Standby Mode**, then remove the electrode from the part being tested. Steps 5 – 8 can be repeated several times.

WARNING: Always release the trigger before removing the electrode from the part under test. This ensures that the built-in bleeder resistor will discharge the part being tested.

The **PosiTest *HHD C*** is now ready to use.

Adjusting the Test Voltage and Sensitivity

With the detector powered **ON** and in **Standby Mode**, the current test voltage will be displayed. Press ⊜ to toggle between the following adjustment modes:

+/- kV **Adjust Test Voltage** Use the ⊖ or ⊕ buttons to adjust the test voltage. The voltage can be adjusted in 10V increments between 500V and 1,000V, and in 100V increments between 1kV and 30kV. Press ⊜ to accept and exit.

+/- mils **Adjust to coating thickness (mils)** Use the ⊖ or ⊕ buttons to set your expected coating thickness in mils. Press ⊜ to accept and exit. The test voltage will be calculated according to the equation below.

+/- μm **Adjust to coating thickness (microns)** Use the ⊖ or ⊕ buttons to set your expected coating thickness in microns. Press ⊜ to accept and exit. The test voltage will be calculated according to the equation below.

$$V = 1,500 + 1.5[170 + 2.48d + 58\sqrt{d}] \text{ (microns)}$$
$$V = 1,500 + 1.5[170 + 63d + 293\sqrt{d}] \text{ (mils)}$$

where V = Voltage in volts $\quad$ d = Thickness of coating

+/− µA | **Sensitivity Adjustment** By default, the Sensitivity of the detector is factory-set to ensure that the instrument alarms when holidays are detected, while ignoring 'false positives' due to surface moisture, electrode movement, etc. For most applications, the default sensitivity setting is ideal.

To verify that the Sensitivity is set correctly, attach the electrode to be used for the desired application, and find a known holiday in the coating or place a shim with the same thickness as the coating over the bare substrate with a 1mm diameter hole drilled in the center. Ensure that the **PosiTest *HHD C*** detects the holiday or hole in the shim, and that it does not alarm over areas without defects or holidays.

If a sensitivity adjustment is required press the ⊖ or ⊕ buttons to adjust the sensitivity. Press ☰ to accept and exit.

NOTE: Test Voltage and Sensitivity adjustments are retained during power cycles.

Instrument Operation

IMPORTANT: To reduce the possibility of building static charge on the object under test, the following steps should always be followed when using the **PosiTest *HHD C***:

1. Perform all steps listed in the "Quick Start" (pg. 4).

2. Enable **Detection Mode** by holding the trigger of the instrument. The **PosiTest *HHD C*** will output high voltage at the selected test voltage. The lightning bolt icon ⚡ will appear at the bottom of the display, and the instrument will emit a tick sound while **Detection Mode** is enabled.

The voltage output of the **PosiTest *HHD C*** is regulated and maintains the test voltage under normal electrode loading. When in **Detection Mode**, the voltage at the electrode is displayed on the **PosiTest *HHD C***. Minor fluctuations on the display are normal during inspection as the **PosiTest *HHD C*** is regulating the test voltage. When the electrode is connected to ground, the display will show "---" indicating that the electrode voltage is less than the minimum of 500V.

3. Place the electrode on the surface of the part you will be testing.

4. Move the electrode over the coated surface at a travel speed not to exceed 0.3m/second (1ft/second) to locate defects. If a holiday is detected, the **PosiTest *HHD C*** will activate the strobe and audio alarm.

5. Release the trigger to deactivate the high voltage output and return the **PosiTest *HHD C*** to **Standby Mode**. The electrode voltage and lightning bolt icon $\frac{1}{2}$ will continue to be displayed until the electrode and surface have discharged. DO NOT touch the electrode or surface if the lightning $\frac{1}{2}$ bolt is shown on the display.

6. Remove the electrode from the surface.

NOTE: The **PosiTest *HHD C*** includes a built-in bleeder resistor, which will discharge the surface when the electrode is in contact with the part and the detector is not generating high voltage.

WARNING: Removing the electrode from the surface while in **Detection Mode** could leave the surface charged. Touching a charged surface could result in electrical shock.

Calibration and Verification

Calibration

The **PosiTest *HHD C*** is shipped with a Certificate of Calibration showing traceability to a national standard. DeFelsko recommends customers establish calibration intervals based upon their own experience and work environment. A detector used frequently, roughly, or in harsh operating conditions may require a shorter calibration interval than if used less frequently and handled with care. Based on our product knowledge, data and customer feedback, a one-year certification interval from either the date of calibration, date of purchase, or date of receipt is a typical starting point.

Verification

The **PosiTest *HHD C*** includes an integrated voltmeter which measures and displays the output voltage of the detector on the display. This provides the ability to monitor the generated voltage

of the **PosiTest *HHD C*** to a voltage within the 500V – 1,000V range in 10V steps, and 1kV – 30kV range in 100V steps. The **PosiTest *HHD C*** integrated voltmeter is accurate to ± 5% of the generated test voltage.

The **PosiTest *HHD C* Verifier** is available for verifying the accuracy of the **PosiTest *HHD C*** and other continuous DC high voltage holiday detectors and is an important component in fulfilling both ISO and in-house quality control requirements.

Learn more at: https://defelsko.com/hhdc/verifier

Battery Status, Charging, and Installation

The **PosiTest *HHD C* Kit** includes four removable, rechargeable 18650 Lithium-ion cell batteries. It is recommended that the batteries be charged after each use.

The battery icon on the display will turn red with one bar remaining when the batteries are low. This indicates that the batteries require charging.

To charge the batteries, insert them into the supplied charger. Each time the charger is connected to a power supply, and no buttons are pressed, the charger will enter the default charging mode, appropriate for the supplied batteries.
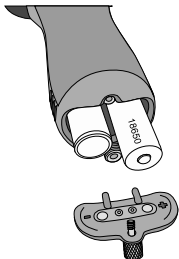
Protected 18650 Lithium-ion cell batteries are recommended for use with the **PosiTest *HHD C***. Only batteries supplied by DeFelsko should be used.

Storing the PosiTest *HHD C*

When not in use, the **PosiTest *HHD C*** should be stored in the supplied hard shell case. Keep the instrument clean and dry. After use, clean the instrument with a soft, damp cloth, and then wipe dry. Do not use solvents such as lacquer thinner, methyl ethyl ketone (MEK), etc.

IMPORTANT: Keep all electrical contacts clean.

PosiTest *HHD C* Troubleshooting

PosiTest *HHD C* will not detect holidays

- **Check Electrode Connections:** With the detector powered OFF, check all connections. Ensure the electrode is fully engaged within the electrode collar of the **PosiTest *HHD C*** and the thumb screw is secured.

- **Check Ground Connections:** With the detector powered OFF, remove the ground cable and then fully reinsert it into the ground socket. Finger tighten the nut by turning clockwise. Ensure the opposite end is clean and well connected to the substrate of the coating system being inspected.

- **Check Test Voltage:** If the test voltage is too low, the **PosiTest *HHD C*** will not find holidays.

- **Reduce Travel Speed:** Recommended travel speed of the **PosiTest *HHD C*** is a maximum of 0.3m/second (1ft/second).

PosiTest *HHD C* turns OFF while in use

- **Check Batteries:** Low or defective batteries will not be able to sustain the power required to operate the **PosiTest *HHD C***. Charge or replace the batteries.

When generating high voltage, the PosiTest *HHD C* display is lower than the test voltage.

- The **PosiTest *HHD C*** integrated voltmeter ALWAYS displays the actual voltage being generated (± 5%). Although the **PosiTest *HHD C*** will regulate the output voltage to match the test voltage, there are circumstances when it is not possible to generate the test voltage. For example, overloading of the electrode by setting the voltage higher than recommended for the coating system under inspection may result in a generated voltage lower than the test voltage. Reducing the brush or electrode size will also reduce loading.

$C\epsilon$ The **PosiTest *HHD C*** meets the Electromagnetic Compatibility Directive and Low Voltage Directive when operated in **Standby Mode**.

Returning for Service

Before returning the **PosiTest *HHD C*** for service –

1. Install fully charged batteries in the correct orientation.

2. Inspect all wires, plugs, and connectors for damage.

3. Power up **PosiTest *HHD C*** by pressing the power button ⏻.

4. Press and hold the trigger.

5. Touch the electrode to ground (earth) to simulate a holiday.

6. If the **PosiTest *HHD C*** does not activate the **Audio** and **Strobe** alarms or create an arc, **remove the batteries** and return the **PosiTest *HHD C* without the batteries** for service.

IMPORTANT:
If you must return the **PosiTest *HHD C*** for service, please follow the instructions provided at
https://www.defelsko.com/service-support#Service

Limited Warranty, Sole Remedy and Limited Liability

DeFelsko's sole warranty, remedy, and liability are the express limited warranty, remedy, and limited liability that are set forth on its website: www.defelsko.com/terms

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PosiTest® *HHD*
High voltage Holiday Detector

Instruction Manual

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Introduction

The **PosiTest *High voltage Holiday Detector*** (HHD) is a Pulse Type DC Holiday Detector designed to locate small defects and discontinuities (called "pinholes" or "holidays") in a protective coating system applied to a conductive substrate. High voltage holiday detectors are commonly used to inspect non-conductive coatings thicker than 500 μm (20 mils).

Designed for maximum versatility, the **PosiTest *HHD*** can be used in either a stick-type or wand-type configuration (when used with the optional wand accessory).

The **PosiTest *HHD*** has two primary operating modes:

1. **Standby Mode:** The detector is powered up but not generating a high voltage.

2. **Detection Mode:** The detector is generating a high voltage and analyzing electrode voltage and current to determine if holidays are present. Holidays can be detected when the charged electrode is passed over the coated surface. When a holiday is encountered, current flows from the electrode into the substrate. The current returns to the detector through the ground (earth) wire, completing the circuit and triggering audible and visible alarms. An integrated peak reading voltmeter measures and displays the output voltage on the display while in use.

Operational Safety

IMPORTANT: DeFelsko recommends that the operator read and fully understand this manual prior to using the **PosiTest *HHD***.

WARNING: ⚡ ⚠ This equipment generates high voltages up to 35,000V (35kV). Accidental contact with the electrode may result in an electric shock. Always keep the working end of the electrode away from your body and never touch it when activated. The **PosiTest *HHD*** operator should exercise all due care to minimize their risk of electric shock and be aware of all relevant safety guidelines before using this equipment. When in **Detection Mode** (pg. 1) generating high voltage or if an arc is being produced, the **PosiTest *HHD*** will generate broadband Radio Frequency emissions. Care must be observed in the vicinity of sensitive electronics or radio equipment.

For safe **PosiTest *HHD*** operation:

DO NOT —

 ⬥ Use in wet or rainy conditions.

 ⬥ Use if you are fitted with a pacemaker.

 ⬥ Use without first connecting the ground (earth) cable.

 ⬥ Touch or allow anyone else to touch the object being tested.

DO —

 ⬥ Ensure that all connections are secure and tight.

 ⬥ Wear appropriate gloves and footwear.

 ⬥ Use flagging tape and signage to keep other personnel away from the testing area.

 ⬥ Communicate the hazards associated with holiday testing with all personnel on-site via tailgate meetings or Field Level Hazard Assessments.

 ⬥ Power OFF the detector before touching the spring or brush.

 ⬥ Confirm the testing voltage requirements and ensure this is communicated to all personnel involved or working in the area.

PosiTest *HHD* Kit

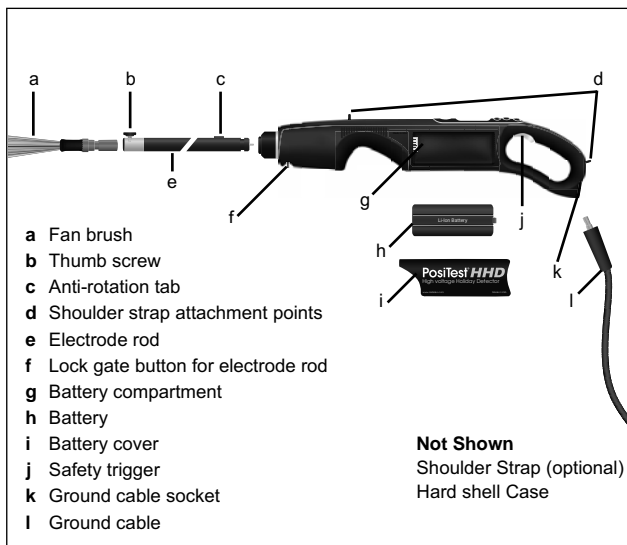The **PosiTest *HHD* Kit** contains the following materials.

A   **PosiTest *HHD***

B   Electrode Rod & Thumb Screw

C   Stainless Steel Fan Brush

D   7.6 m (25') Ground (earth) cable with Ground Clip

E   Shoulder Strap (optional)

F   Li-ion Battery Pack with built-in charge state indicator

G   Smart Battery charger with universal AC voltage input

     Hard shell case (not shown)

Accessories

A variety of optional and replacement accessories are available to help you get the most out of your **PosiTest *HHD***.
See www.defelsko.com/hhd to learn more.

PosiTest *HHD* Overview

a Fan brush
b Thumb screw
c Anti-rotation tab
d Shoulder strap attachment points
e Electrode rod
f Lock gate button for electrode rod
g Battery compartment
h Battery
i Battery cover
j Safety trigger
k Ground cable socket
l Ground cable

Not Shown
Shoulder Strap (optional)
Hard shell Case

Speaker

Strobe alert

LCD display

Control panel

Quick Start

The **PosiTest** *HHD* powers-up when the power button ⏻ is pressed. To preserve battery life, it powers down after approximately 5 minutes of no activity. Alternatively, select ⏻ from the menu for immediate power down. All settings are retained.

1. Review **Operational Safety** (pg. 2).

2. Assemble the detector for the application to be tested – **"Assembly Instructions"** (pg. 5).

3. Properly ground the instrument – **"Grounding"** (pg. 6).

4. Confirm that the detector is in proper working condition – **"Operational Check"** (pg. 6).

5. Set the test voltage – **"Adjusting the Test Voltage"** (pg. 7).

6. Verify the sensitivity setting and adjust if necessary – **"Adjusting the Sensitivity"** (pg. 9).

7. Perform the test – **"Instrument Operation"** (pg. 9).

Assembly Instructions

STEP 1. Attach the Electrode Rod: Press and hold the lock gate button while inserting the rod. Ensure the anti-rotation tab on the rod is aligned with the corresponding receptacle on the **PosiTest** *HHD*. Release the lock gate button and ensure the rod is securely attached.

STEP 2. Attach the Electrode: Loosen the thumb screw on the free end of the electrode rod, attach the required electrode (or adaptor), and re-tighten the thumb screw.

STEP 3. Attach the Ground Cable: Align the flat side of the cable connector pin with the alignment mark in the ground cable socket on the detector, insert fully and rotate the connector clockwise 180° to secure the cable. Rotate the cable connector 180° counter-clockwise to unlock and remove the ground cable. (see **"Grounding"** pg. 6)

STEP 4. Attach the Shoulder Strap (optional): Clip the strap to the shoulder strap attachment points.

STEP 5. Install the Battery: Loosen the screw on the battery compartment and remove the cover. Install the battery in the correct orientation. Replace the cover and secure with the screw.

Grounding

Ensure the ground (earth) cable is uncoiled and fully extended. Connect the ground clip to an exposed (uncoated) area of the part, or grounding rod. If no ground is available, a trailing ground wire, grounding collar, or grounding mat may be used. Verify that the instrument is properly grounded by touching the electrode to the grounded substrate, ensuring that the audible and visual alerts are properly triggered.

WARNING:

Never touch the ground cable while the detector is operating.

Operational Check

Prior to each use, the **PosiTest *HHD*** should be checked to ensure it is operating correctly. This operational check ensures that the audible and visual alerts are operating properly and the instrument has voltage output. For **Calibration and Verification** see pg. 11.

Performing an Operational Check

1. Ensure the instrument and all components are assembled.

2. Visually inspect each cable and connection.

3. Press and release the power button ⏻ on the top of the **PosiTest *HHD***.

4. The **PosiTest *HHD*** should power on and display the test voltage.

5. Press and hold the ⏻ button and then activate and hold the safety trigger on the **PosiTest *HHD*** to turn on the high voltage and activate **Detection Mode**. The ⏻ button can now be released.

6. The **PosiTest *HHD*** should begin testing at the selected voltage. The display will show the voltage being generated.

7. Touch the electrode to the bare ground wire or grounded substrate of the part being inspected. Note the audible and visual alerts. Repeat this step several times.

NOTE:
A spark may or may not be seen and heard. When using a lower test voltage and on bright sunny days, the spark may not be seen or heard.

8. Release the safety trigger to turn high voltage OFF and return the **PosiTest *HHD*** to **Standby Mode**.

The **PosiTest *HHD*** is now ready to use.

Adjusting the Test Voltage

1. With the detector powered **ON** and in **Standby Mode**, press $\equiv$ to open the menu and then select the **Voltage Set** icon $\mathbf{V}$.

2. The detector will display the test voltage.

3. Use the $\ominus$ or $\oplus$ buttons to adjust the voltage. The voltage adjusts in 10V increments between 500V and 1,000V, and in 100V increments between 1kV and 35kV.

4. Select **OK** with the $\equiv$ button to save the voltage and exit.

The inspection voltage should be obtained from the coating manufacturer's specification or by contacting the coating manufacturer. Based on international standards, formulas and tables can be used as a guide for setting voltages on various coating thicknesses. A sample calculation from NACE International Standard Practice SP0274-2011 is as follows:

$V = 1,250 \sqrt{T}$ (mils)   where V = Voltage in volts

$V = 7,900 \sqrt{T}$ (mm) T = Thickness of coating

NOTE: The formula and suggestions for setting voltage are supplied as a guide. Always consult the coating manufacturer for recommended voltage settings.

The voltage output of the **PosiTest *HHD*** is regulated and maintains the test voltage under normal electrode loading. When in **Detection Mode**, the test voltage being generated is displayed on the **PosiTest *HHD***. Minor fluctuations on the display are normal during inspection as the **PosiTest *HHD*** is regulating the test voltage. When the electrode is connected to ground, the display will show "---" indicating that the generated voltage is less than the minimum of 500V.

Adjustment using the built-in Voltage Calculator

The **Voltage Calculator** simplifies the task of setting the correct test voltage for a particular coating system. It prompts the user to enter the coating thickness on the part to be tested and the standard the user is conforming to, and automatically calculates the correct test voltage.

1. With the detector powered **ON** and in **Standby Mode**, press ≣ to open the menu then select the **Voltage Calculator** icon from the Menu.

2. The gage will display a list of common international standards.

3. Use the ⊖ or ⊕ button to highlight the desired standard.

4. Press the ≣ button to select the desired standard.

5. Depending on the selected standard, a **Units Selection** menu may appear. If prompted, select the desired coating thickness measurement units.

6. A thickness adjustment screen is now shown. Using the ⊖ or ⊕ button, adjust the coating thickness to the maximum thickness of the coating to be inspected.

NOTE: Depending on the standard chosen, the range of selectable coating thicknesses may be limited.

7. Press the ≣ button to select the thickness. The **PosiTest** *HHD* will now calculate the test voltage based on the standard and units selected.

The following standards are available when using the Voltage Calculator:

> AS 3894.1:F1, F2, F3, F4
>
> ASTM D4787, D5162, G62
>
> ISO 29601
>
> NACE SP0274, SP0188, SP0490

NOTE: Voltage adjustments will be retained when the **PosiTest** *HHD* is powered OFF. Perform a **RESET** (pg. 12) to return to the default voltage setting (1kV).

Adjusting the Sensitivity

By default, the Sensitivity of the **PosiTest** *HHD* is factory-set to ensure that the instrument alarms when holidays are detected, while ignoring 'false positives' due to surface moisture, electrode movement, etc. For most applications, the default sensitivity setting is ideal.

To verify that the Sensitivity is set correctly, attach the electrode to be used for the desired application, and find a known holiday in the coating or place a shim with the same thickness as the coating over the bare substrate with a 1mm diameter hole drilled in the center. Ensure that the **PosiTest** *HHD* detects the holiday or hole in the shim, and that it does not alarm over areas without defects or holidays. If a sensitivity adjustment is required:

1. With the detector powered ON and in Standby Mode, press ☰ to open the menu and then select the Sensitivity Icon ☀.

2. Use the ⊕ or ⊖ buttons to adjust the sensitivity.

3. Verify the sensitivity setting as outlined above. If the sensitivity is too high (slider too far to the right) the instrument may alarm when no holiday is present. If the sensitivity is too low (slider too far to the left) the instrument may fail to alarm when a holiday is present.

NOTE: The sensitivity setting is retained during power cycles. After a Reset (pg. 12) the sensitivity is set to default.

Instrument Operation

IMPORTANT: The **PosiTest** *HHD* is ready for testing only after performing **Steps 1-6** in the **Quick Start** (pg. 5).

1. Press the power button ⏻ to power up the detector. The **PosiTest** *HHD* is now in **Standby Mode** (pg. 1).

2. Press the ☰ button to access the menu. Navigate using the ⊖ or ⊕ buttons. Press ☰ to select.

3. Select the preferred **Audio** and **Strobe Alarm** settings (pg. 11).

4. Adjust the test voltage (pg. 7).

5. To activate the high voltage output and enable **Detection**

Mode, press and hold the power button (⏻) and activate and hold the safety trigger. The lightning bolt icon ⚡ will appear at the bottom of the display and the **PosiTest *HHD*** will show the test voltage being generated.

6. Continue holding the safety trigger and release the power button (⏻).

7. Move the electrode over the coated surface at a travel speed not to exceed 0.3m/second (1ft/second) to locate defects. If a holiday is detected, the **PosiTest *HHD*** will activate the strobe and/or the audio alarm (depending upon setup).

8. Release the safety trigger to deactivate the high voltage output and return the **PosiTest *HHD*** to **Standby Mode** (pg. 1).

Measuring on Concrete

The conductivity of concrete is directly related to its moisture content. To optimize the **PosiTest *HHD's*** ability to detect holidays in coatings applied over concrete, **Concrete Mode** 🛺 should be enabled.

• Attach the **PosiTest *HHD*** ground cable to exposed rebar, pipe or other metal structure embedded in the concrete. Alternatively, the ground cable can be placed on top of an area of uncoated concrete using damp sandbags.

• Ensure **Concrete Mode** is enabled from the **PosiTest *HHD*** Menu. The **Concrete Mode** icon 🛺 will appear on the display.

• **Ensure that the electrode is in contact with the coating in an area with no holidays before activating the high voltage output.** In concrete mode, the **PosiTest *HHD*** only regulates the output voltage for the first half-second after the high voltage output has been activated. If, while testing, the displayed test voltage decreases due to changes in concrete moisture, simply deactivate and reactivate the high voltage output while keeping the electrode in contact with the coating.

NOTE: If the high voltage output is activated while the electrode is not in contact with the coating or if a holiday is present, a voltage drop may be noticed when the electrode is placed on the coating.

• To turn off **Concrete Mode**, select 🛺 from the **PosiTest *HHD*** Menu.

Calibration and Verification

Calibration

The **PosiTest** *HHD* is shipped with a Certificate of Calibration showing traceability to a national standard. DeFelsko recommends customers establish calibration intervals based upon their own experience and work environment. A detector used frequently, roughly, or in harsh operating conditions may require a shorter calibration interval than if used less frequently and handled with care. Based on our product knowledge, data and customer feedback, a one-year certification interval from either the date of calibration, date of purchase, or date of receipt is a typical starting point.

Verification

The **PosiTest** *HHD* includes an integrated voltmeter (crest meter, jeep meter) which measures and displays the peak output voltage of the detector on the LCD display. This provides the ability to monitor the generated voltage of the **PosiTest** *HHD* to a specific voltage within the 500V – 1,000V range in 10V steps, and 1kV – 35kV range in 100V steps. The **PosiTest** *HHD* integrated voltmeter is accurate to +/- 5% of the generated test voltage.

The **PosiTest** *HHD Verifier* is available for verifying the accuracy of the **PosiTest** *HHD* and other high voltage holiday detectors and is an important component in fulfilling both ISO and in-house quality control requirements.

Learn more at: http://defelsko.com/hhd/verifier

Settings

Audio Alarm

The **PosiTest** *HHD* has three audio alarm modes. Select the 🔊 icon from the menu to select an alarm mode.

Audio Alarm is OFF

The detector emits a continuous tone when high voltage is on and a loud alarm tone when a holiday is detected. This is the default audio alarm mode.

The detector emits a loud, continuous tone when high voltage is on and is silent when a holiday is detected.

The selected audio alarm mode is retained during power cycles.

Strobe Alarm: The **PosiTest** *HHD* uses a high-intensity white LED to alert the operator when a holiday is detected.

Strobe On

WARNING: This visual alert may affect operators who are susceptible to photosensitive epilepsy or other photosensitive conditions.

The strobe alarm can be turned ON or OFF:
Select the strobe icon 💡 or 💡 to toggle the strobe alarm state. A red 💡 icon will appear on the display when the strobe alarm is turned off.

Strobe Off

The strobe alarm setting is retained during power cycles.

Reset: Perform a reset of the **PosiTest** *HHD* by selecting ↻ from the Menu. A reset restores factory settings and returns the detector to a known condition. Settings are returned to the following:

Output voltage = 1kV
Audio Alarm = Continuous tone when high voltage is on and loud alarm when a holiday is detected
Strobe alarm = ON

Power OFF: Select to power down the **PosiTest** *HHD*. All settings are retained.

Return/Exit Menu: Select to return to a previous menu or exit the menu.

Wand Mode: When the optional wand accessory is used, it may be desirable to enable **Detection Mode** (high voltage output) without the need to keep the trigger activated continuously. To activate the **Wand Mode** press and hold the power button. Activate the trigger, then release the trigger while continuing to hold the power button until a lock icon 🔒 is displayed on the LCD. Once the lock icon is displayed, the power button can be released and the **PosiTest** *HHD* will remain in **Detection Mode** without the trigger needing to be activated. To disable **Wand Mode**, press any button or activate the trigger.

NOTE: **Wand Mode** is not available if the test voltage is greater than 15kV.

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Battery Status, Charging and Installation

The **PosiTest *HHD* Kit** includes a removable, rechargeable lithium-ion battery. It is recommended that the battery be charged after each use.

The battery icon 🔋 on the display will turn red with one bar remaining when the battery is low. This indicates that the battery requires charging.

The battery also features a built-in charge state indicator. Press the button on the battery to display the remaining power. The charger automatically switches between 110V and 240V AC making it ideal for use worldwide.

NOTE: The transport of Li-ion batteries is regulated. The supplied Li-ion battery has been manufactured in accordance with the UN Manual of Tests and Criteria Part III subsection 38.3. When transporting the **PosiTest *HHD*** or shipping the battery separately, observe all local regulations.

IMPORTANT: Always contact your carrier prior to shipping this battery to ensure compliance with local regulations.

CAUTION: Use care when handling the rechargeable Li-ion battery. The battery may be damaged if dropped. NEVER use a cracked, swollen or otherwise damaged battery. DO NOT puncture, disassemble or modify the battery. DO NOT expose the battery to high temperatures or dispose in fire.

Storing the PosiTest *HHD*

When not in use, the **PosiTest *HHD*** should be stored in the supplied hard shell case. Keep the instrument clean and dry. After use, clean the instrument with a soft, damp cloth, then wipe dry. Do not use solvents such as lacquer thinner, methyl ethyl ketone, etc.

IMPORTANT: Keep all electrical contacts clean.

PosiTest *HHD* Troubleshooting

PosiTest *HHD* will not detect holidays

◆ **Check Electrode Connections:** With the detector powered OFF, check all connections. Ensure the electrode rod is fully engaged within the barrel of the **PosiTest *HHD*** and the lock gate is engaged.

◆ **Check Ground Connections:** With the detector powered OFF, remove the ground cable and fully reinsert it twisting clockwise 180° until locked. Ensure the opposite end is clean and well connected to the substrate of the coating system being inspected.

◆ **Check Test Voltage:** If the test voltage is too low, the **PosiTest *HHD*** will not find holidays.

◆ **Reduce Travel Speed:** Recommended travel speed of the **PosiTest *HHD*** is a maximum of 0.3m/second (1ft/second). Since the **PosiTest *HHD*** operates at a pulse repetition rate of 30 pulses per second, it is possible to miss holidays if the travel speed exceeds the recommended maximum.

PosiTest *HHD* turns OFF while in use

◆ **Check Battery:** A low or defective battery will not be able to sustain the power required to operate the **PosiTest *HHD***. Charge or replace the battery.

When generating high voltage, the PosiTest *HHD* display is lower than the test voltage.

◆ The **PosiTest *HHD*** integrated jeep/crest meter ALWAYS displays the actual voltage being generated. Although the **PosiTest *HHD*** will regulate the output voltage to match the test voltage, there are circumstances when it is not possible to generate the test voltage. For example, overloading of the electrode by setting the voltage higher than recommended for the coating system under inspection may result in a generated voltage lower than the test voltage. Reducing the brush or electrode size will also reduce loading.

Accessories

A variety of optional accessories are available to help you get the most out of your **PosiTest *HHD***.

- Handheld Wand w/ 1.5m (5') Insulated Cable
- 10cm (4") Conductive Rubber Paddle
- Steel Flat Wire Brushes
- Steel Rolling Spring Electrodes
- Rolling Spring Electrode Connector
- Rolling Spring Coupler (sold in pairs)
- **PosiTest *HHD Verifier*** (Calibrated peak reading voltmeter can be used to verify operation of the **PosiTest *HHD***.)
- Tinker & Rasor Electrode Adaptor
- PCWI Electrode Adaptor
- 266 & 280 Electrode Adaptor

For a complete list of accessories see: www.defelsko.com/hhd

Technical Data/Specifications

- **Type:** Pulse DC (30Hz)

- **Range:** 500 – 35,000V

- **Resolution:** 500 – 1,000V in 10V increments, 1kV – 35kV in 100V increments

- **Output Accuracy:** $\pm$5%

- **Operating Temperature Range:** -20° to 60° C (-4° to 140° F)

- **Battery:** Rechargeable Smart Li-ion battery

- **Battery Life:** Depends on test voltage and electrode load

- **Weight:** 1.8 kg (4 lbs.) with battery (no electrodes)

- **Dimensions** (no attachments)**:** 64 cm x 6.4 cm x 13 cm
  (25" x 2.5" x 5")

Applicable Standards: AS 3894.1, ASTM D4787, ASTM D5162, ASTM G62, ISO 29601, NACE SP0274, NACE SP0188, NACE SP0490.

CE The **PosiTest *HHD*** meets the Electromagnetic Compatibility Directive and Low Voltage Directive when operated in **Standby Mode**.

Returning for Service

Before returning the **PosiTest** *HHD* for service –

1. Install a fully charged battery in the correct orientation.

2. Inspect all wires, plugs, and connectors for damage.

3. Power up **PosiTest** *HHD* by pressing the power button ⊜.

4. Reset the **PosiTest** *HHD* (See pg. 12).

5. Press and hold power button while activating the trigger.

6. Connect end of electrode rod to ground (earth) lead to simulate a holiday.

7. If the **PosiTest** *HHD* does not activate the **Audio** and **Strobe** alarms or create an arc, **remove the battery** and return the **PosiTest** *HHD* **without the battery** for service.

IMPORTANT:
If you must return the **PosiTest** *HHD* for service,
please follow the instructions provided at
https://www.defelsko.com/service-support#Service

Limited Warranty, Sole Remedy and Limited Liability

DeFelsko's sole warranty, remedy, and liability are the express limited warranty, remedy, and limited liability that are set forth on its website: www.defelsko.com/terms

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