FIL LTD.

DayCor®II

The Most Advanced Daytime Corona Imager

The Indispensable Predictive Maintenance Tool to Enhance Electrical Utility Reliability

Innovation

Ofil's **DayCor®II** is today's most advanced and sensitive daytime UV corona detection camera. With the help of *EPRI* and leading US electrical utilities the **DayCor®II** features were tailored to the specific needs of the electrical utilities.

The **DayCor®II** is being used for over two years by maintenance teams of more than fifty major electrical utilities and leading electrical power research institutes. Maintenance teams are using the **DayCor®II** for inspection in transmission, distribution, substations , in ground patrol, van mounted and airborne.

Application research and field tests of the **DayCor®II ,** carried out by *EPRI,* made the **DayCor®II** an indispensable predictive maintenance tool. The "***Guide to Corona & Arcing Inspection of Over-Head Transmission Lines***" by *Dr. Andrew Phillips* is now available from *EPRI*. This guide contains interpretations of detected corona, the effects on reliability and recommended corrective actions. Access to the guide is possible through Ofil's representatives. **The EPRI guide for Substations** is available as well.

Airborne inspection

Cost-Effective Predictive-Maintenance tool

The **DayCor®II** daytime camera makes corona inspection a low-cost procedure, and eliminates the need for nighttime inspections. Furthermore, daytime capability allows performing safe airborne inspections.

The new **DayCor®II** technology assures power system reliability by detecting defective components at early stages of degradation.

This reduces maintenance costs, minimizes unscheduled outages and facilitates predictive maintenance. The **DayCor®II** can also easily locate RF interferences and audio noise sources.

With the **DayCor®II** technology in hand utilities can monitor polymer insulators' condition when in service, on a regular basis.

A Breakthrough Technology

While thermo-vision detects only hot spots, the **DayCor®II** detects corona and arcing and is therefore a crucial new tool for routine inspections of overhead lines and substations.
With the **DayCor®II** , defective components can be revealed before heat gradient is developed. Early detection is especially important during commissioning of construction projects. Furthermore, UV inspection is voltage dependent and therefore there is no need for line loading for corona inspection.
While IR is excellent in finding high resistance connections, UV detection can locate other problematic conditions such as shorted insulator bells, defective polymer insulators, surface contamination, wrong design or improperly installed components.

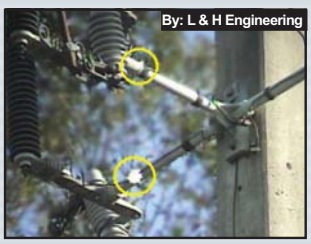
Research Applications

EPRI uses the camera for research and for development of corona inspection applications. The Swedish *STR*I, Mexican *IIE*, Italian *CESI* and the Hungarian *VIEKI* research institutes are also using the **DayCorII™** camera for research.
The last annual DayCor Users Group Meeting (UGM), held in Atlanta Georgia in October 2002, gathered forty-five participants from *EPRI*, *STRI, TVA*, *AEP*, *Gulf Power*, *BPA*, *City Public Service*, *East Kentucky Power Coop*, *SCE&G*, *Manitoba Hydro*, *SDG& E* and others. The experience in corona inspection, presented at the UGM meetings, and information gathered regularly from users is being published periodically in the "Seeing corona" newsletter.

Some Success Stories

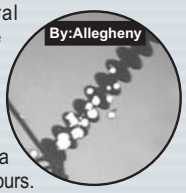
Wrong Installation on a 34 kV Line

One of Florida's municipals utilities had recurring tripping for unknown reasons. The line, a brand new 34 kV of concrete poles, would trip mainly in the morning. Repeated visual inspections failed to reveal the reasons for the problem. This was immediately clarified by a short midday inspection using the **DayCor®II** . Discharge was observed on the grounding wires. It turned out that the construction contractor fastened the grounding wires on the supporting arm at two points instead of at one point, as originally designed. Tripping was caused by a too short clearance between the phase and the additional grounding fastening point, on which discharge was observed.



Proven Cost-Effectiveness by Allegheny

During a periodic inspection, one of Allegheny's maintenance team reported radio interference on several towers. The towers were part of a 28 year-old 500 kV line (Pin and Clevis configuration). An evaluation 3-men team using **DayCor®II** camera examined 8 towers in 5 hours.



The results showed corona on several hot-end bells. These bells were replaced. According to the responsible engineer: "...taking care of such a case would usually require a team of about nine men, working for three days...". An examination of the removed bells showed that the damage caused by the discharge activity could reduce the mechanical strength of the bells and lead to a line drop.

Polution Troubles in SJRPP

The SJRPP substation, serving St. Johns River Power Park, is located in a tough environment. A **DayCor®II** demo inspection was performed right after a periodic dry washing. Despite the washing, a lot of corona activity and flashovers were observed. It turned out that the washing left some of the hard spots unclean.

live flashover captured by the DayCor®II

An IR inspection was carried out simultaneously, giving no indication of these phenomena. In the evening of the inspection day, one of the polluted insulators blew up and caused a blackout. The utility learned that their washing procedure was not satisfactory, and that routine inspection with the **DayCor®II** under the local prevailing conditions is mandatory. Today, the **DayCor®II** is used for control of the washing quality on a regular basis.

Distribution

Pole Tops & Hardware • Switches & Transformers • Connectors • Insulators

Arcing from a 23.4 kV porcelain insulator.

Arcing from a defective pin-and-cap insulator.

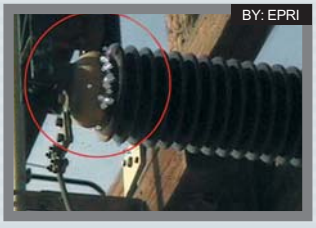
Arcing from a defective polymer cable termination.

Salt polluted glass insulator in a coastal region.

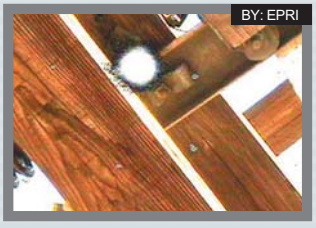
Substations

Insulators, Switches & Busses • Capacitors & Fuses • Termination Hardware • Grounding Connections • Transformers

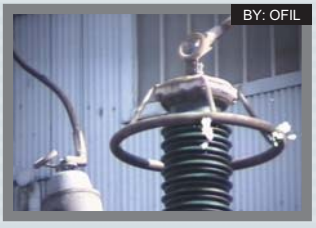
Working facing the sun: a non-corona-free insulator design on a switch.



Arcing from the cap of substation post insulator.



Bad ground connection in a substation.



Corona on a grading ring & lightning arrester.

Transmission

Phase Conductors • Ceramic Insulators • Polymer Insulators • RI/AN Complaints • Broken Strands

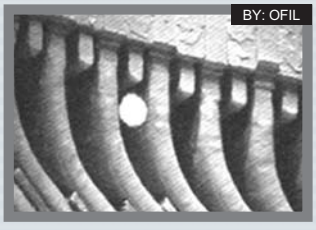
Improperly installed corona ring.

Defective 500 kV porcelain insulator string.

Corona activity observed from a 500 kV NCI.

Heavily polluted insulator on a 161 kV line

Inspection of Motor Coils for Corona

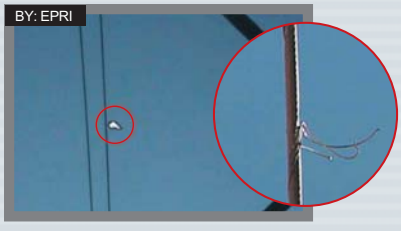


Cracked insulation coating
Viewed at 4.2 kV

Inspection method

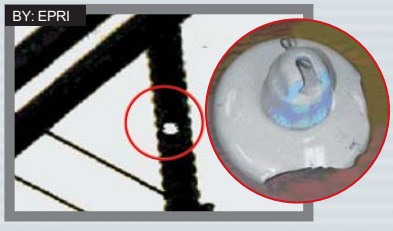
Motor 6.6 kV, 2500 HP after repair:
14,000 pC at 3.8 kV.
Coil was sent for rewinding.

Zoom on Typical Defects



Broken strand on a 345 kV transmission line.

Damaged polymer insulator.



Broken porcelain bell.

A Real-Life Solution

The **DayCor®II** camera detects corona, partial discharge and arcing. It allows convenient inspection of transmission lines from the ground and from an airborne platform. It is also suitable for inspection of distribution lines and substations. Applications of UV inspection for detection of partial discharge on motor coils and dry transformers are in growing demand.

Long-Range Detection - The high sensitivity and narrow field of view of the camera enable the inspector to work from a distance of up to 150 meters (450 feet) away, allowing inspection of towers that are difficult to access.

Highly Ergonomic -The unique carrying vest arrangement of the **DayCor®II** in addition to the large LCD screen reduces the arm and eye strain, typical to handheld cameras. The hands-free operation allows inspectors to use the **DayCor®II**'s functions and take field notes, without having to put the camera aside.

Airborne detection in heavy foggy conditions.

All Lighting and Weather Conditions - the **DayCor®II** can be operated in full daylight as well as at night. In addition, it has been weatherized to allow use in inclement weather. UV corona and arcing observation can be performed under foggy conditions.

The Basic Features of the DayCor®II Camera:

- Automatic focus of both the visible and UV channels.
- LCD: large - to allow sharing with co-workers; with contrast adjustment control - to best fit illumination conditions; with angle of sight adjustment control - for observer's convenience.
- An easy to adjust UV gain control for optimizing corona detection.
- Zooming of the visible image allows to see the defects causing the corona.
- An all-metal case to prevent Electro Magnetic Interference.

Additional Features and Accessories:

- Long time integration - to extend UV channel exposure and amplify weak corona signals while suppressing unwanted background noise.
- A UV events counter - gives comparative measurements of the corona intensity.
- A remote control (RC) unit that controls all functions of the **DayCor®II**. The RC unit is supplied with15m shielded-cable.
- Digital documentation package, mountable on the **DayCor®II,** including a digital camcorder with reflective LCD, high quality video recording on a flash media, audio pre-amp for voice notes, touch screen interface, mega pixel still capability, date and time stamps, long life battery, cables, tapes, microphone, 128MB memory stick and bundled software.

Specifications

Optical Properties

Solar light rejection	absolute
Field of view H x V	5º X 3.75º
UV overlay accuracy	5 cm for 50 m (1 milliradian)
Focus distance	3 m to infinity
Minimum UV sensitivity	$3x10^{-18}$ watt/cm^2
Corona detection sensitivity	1.5-2 pC at 8 m distance (Eurotest)
Video standards	full PAL/NTSC standards
Visible zoom	x2 optical and x8 digital
Dusk time operation	1 Lux

Signal Processing

- Analog UV signal enhancement
- Analog long integration - Number of integrated frames: 5, 9, 13, 16 and 20
- Digital event counting

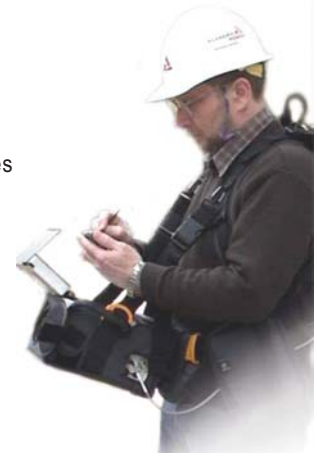
Operation

High resolution LCD	Brightness 320 cd/m2 Resolution 320 x 234 pixels
Video output	PAL/NTSC via BNC jack
Power consumption	12VDC, 16 watt
Weight	5.5 Kg | 12 lb
Dimensions L x W x H	25 x 17 x 15 cm | 9.8" x 6.7" x 5.9"

Operating Controls

UV Gain level; Visible zoom; Status display; Auto/manual focus; Standby mode, Auto/manual exposure; Long integration period; Counting mode.

DayCor®II Ordering Options:



DayCor®II Basic package includes:

- **DayCor®II** camera
- Universal AC/12V DC adapter
- Carrying vest with battery pouch
- Two professional grade NiMH batteries 50 watt-hour (each provides more than three hours of continuous operation)
- "Smart" charger for four batteries
- **DayCor®II** to computer serial cable
- Hard carrying case

Accessories (optional):

- Long time integration
- UV events counter
- Remote control unit
- Digital video documentation package
- Semi rigid carrying case for on-board carrying
- Mount for camcorder
- Voice pre-amp with external microphone

Airborne Gimbaled Option by PolyTech Corona (DayCor®) 350-I

A gyro stabilized system for inspection from helicopters, incorporating the **DayCor®II** in a gimbal, was developed by PolyTech and is available through PolyTech or Ofil.

Contact us:

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