1. Range of Application

The Rad Check System is suitable for determining the intensities of UV radiation emitted by various ultraviolet energy systems with a wavelength range of 320 - 380 nm (UVA range), or for determining the hardening of most materials. Rad Check also can measure the output of Hg lamps as well as of lamps doped with Ga or Fe. The measured dose is determined by the wattage of the lamp plus the speed at which the substrate passes beneath the UV source.

For Hg emitters of 80 W/cm and 120 W/cm, information regarding applications and calibration curves have been provided.

By using the Rad Check 800 test strip, dosage measurements from 0 to approximately 1400 mJ/cm^2 can be made. With the lamp wattage given, and by varying the speed or the cycle number of the unit, it is possible to enter into an intensity range, which can be recorded by the tapes of the Rad Check Dosimeter.

2. Measurement of Radiation by the Rad Check System

The Rad Check System consists of test strips which are exposed to radiation by the UV source, and a measuring instrument (Dosimeter) which measures the decrease, or “extinction”, of the test strip’s optical density. The UV radiation dose in mJ/cm^2 can be easily determined from this decrease in density through a suitable calibration curve.

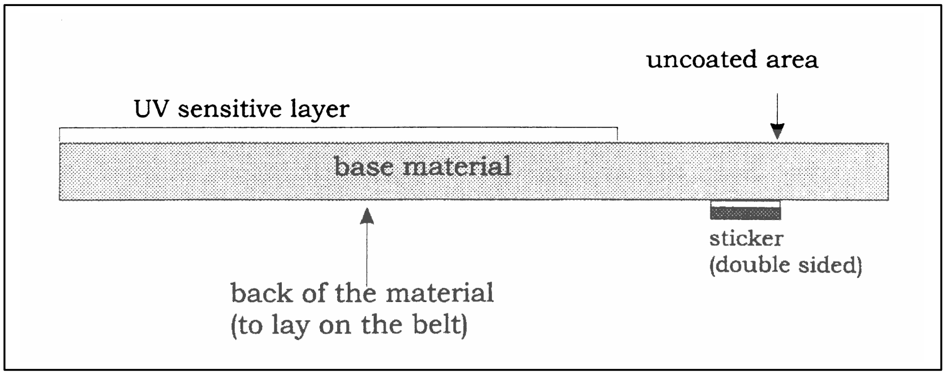
Measuring Principle

Each test strip is coated with a substance that has a sufficiently high sensitivity to UV rays in the range of 320 - 380 nm, a band in the UV/VIS spectrum. When the test strip is exposed to light radiation in this wavelength range, the optical density of the coated band becomes less. The extinction corresponds to the radiated UV dose, and can be determined by the Dosimeter instrument.

Exact dose values can be obtained if you measure with a customary measuring instrument (radiometer) and with the Rad Check test tape at the same time. Different intensities can be measured by adjusting lamp wattage. By equating the Test Strip values with the corresponding radiometer measurements, a calibration curve specific for the lamp can be developed.

Composition of the Test Strips

The test strips consist of a supporting material made of polyester film. This film is covered with a coating layer which is sensitive to UV rays. On the back of the tape, there is a double-sided sticking strip which is used to fix the tape to the material to be exposed.



Handling and Storage

As the test strip coating is sensitive to UV rays, it can also be destroyed when exposed to sunlight. Therefore, it is necessary to provide light-proof packing at all times. The test strip packing offers complete protection against exposure. Be sure to close the packing after each use. Also be sure to process the strips immediately after removal from the pack. Processing at diffused room light will not harm the strips, although you should avoid any direct exposure to the sun radiation and **fluorescent lamps.**

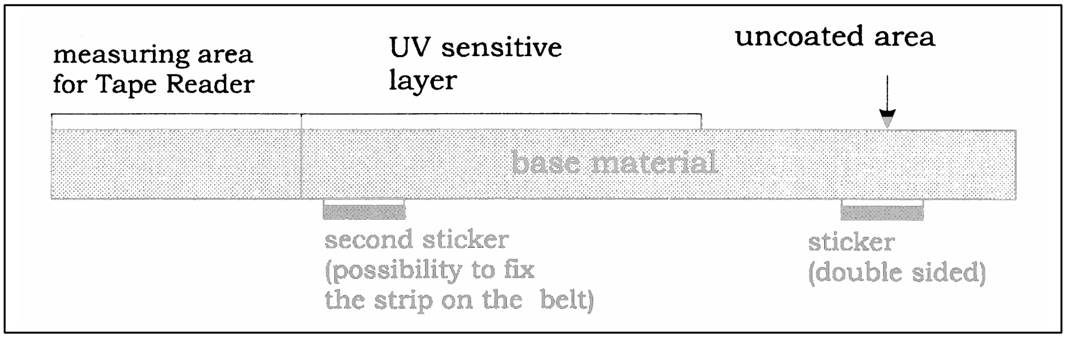
In addition, the test strips have a certain thermal sensitiveness. Therefore, it is necessary to store Rad Check material in the refrigerator. Limited storage or transport at room temperature is possible.

Exposure of the Test Strip

After the test strip is removed from its pack, expose it to the UV source without delay. Using the strip's adhesive tab, attach the strip to the cylinder, belt or substrate which will be exposed to the radiation source.

Please note that improper placement of the strip during the exposure sequence may provide inaccurate dosage readings.

At high speeds, a second test sequence may be required to verify the initial reading results. Attach it in such a way that the subsequent measurement at the Dosimeter is not impaired.

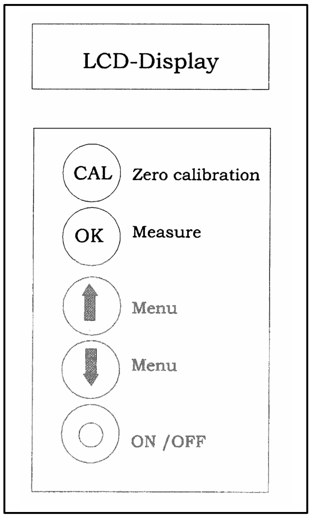


After the tape has passed through the radiation source, the optical density, or extinction, should be measured immediately.

Measurement of UV Intensity

Structure and Functioning of the Dosimeter Measuring Instrument (Brief Description)

Measuring principle:	Photometric transmitted-light measurement of test strips sensitive to UV radiation
Light source:	12v, 16 W commercial halogen lamp
Sensor:	UV-selective photodiode max. rel. sensitivity: 320 nm 50% rel. sensitivity: 300 - 360 nm
Measuring transformer:	Aluminium block to support the halogen lamp; photodiode, and guidance for measuring tape with end stop.
Power:	110/220v



View to the surface of Dosimeter

Execution of instrument

Connect the instrument to the 12v adapter. Switch "On" the instrument.

Dosimeter	Access announcement
Start Zero Point	Request for the calibration of the zero point

To calibrate the zero point, slide a tape of uncoated supporting film - calibrating strip or uncoated portion of test strip - into the Sensor guide up to the end stop, and press CAL.

The display reads:

Zero Point Please Wait	Calibration of the zero point, (duration: 5 - 10 sec.) Flashing at the top right comer
Dosimeter Read to Measure	The calibrated zero point remains stored.

Afterwards, insert the test strip into the Sensor guide up to the end stop (the white point located by the inscription "UV Sensor" indicates the point of measurement).

For this reason, do not wrIte, stick or contaminate the tapes up to a length of approximately 30mm.

Unlike when the strip is exposed, when the coated side must face the UV source, the test strip can be measured whether the coated side faces up or down.

Press the button OK = measurement

Measurement Please Wait	Measurement, duration approx. 3 sec. Flashing at the top right comer
Extinction "0.6"	Indication of . measuring result

Several measurements can be carried out with the stored zero point. After approximately 10 readings, or after receiving a non-linear reading, the zero point should be recalibrated.

By building a calibration curve using the optical density value in conjunction with standard radiometric readings, you can determine UV intensity using the test strip and dosimeter.

On the Dosimeter menu, several functions can be recalled or modified. To make a change, press the two arrow buttons. A called or modified menu option is always confirmed by pressing "OK". By pressing the button ON/OFF, the previous menu level is reached. The following options are available in the menu:

1. language	alternately German or English.
2. battery	measurement of the supply voltage with the switched "On" lamp.
3. date	regulation of the actual date on the integrated real-time dock.

4. time	as under 3.
5. K-factor	provides a correction of deviations in different test strip batches.
6. autom. OFF	time for the automatic switch-off after the measurement has been completed.
7. system check	check of the electronic equipment.

K factor (reader calibration):
The K factor is numerical percentage value that allows the operator to accommodate for the different density values that may occur between different batches of test strips. By adjusting this value, the operator can establish a standardized baseline value for subsequent batches of test strips regardless of their density values. This allows the operator to obtain comparable measurements from different batches of test strips even though their density values may differ.

How to use the K Factor to calibrate different batches of Test Strips

1. When you receive your first batch of test strips, follow the instructions for reading a test strip provided above. Place an unexposed test strip into the reader and take a reading. This reading will provide you with the baseline value of the batch of test strips (batch number marked on the outside of each strip package). As there may be slight variations from strip to strip (approximately 2%), repeat this procedure for three strips from the same batch to obtain your baseline value. When measuring using this test strips batch, do not adjust the K factor. This becomes the instrument's baseline value.

2. When you receive subsequent batches of test strips, take readings of three unexposed strips from the new batch. If there is no variation between readings of the unexposed strips from the first batch to the next, do not change the K factor. If there is a variation, divide the initial baseline reading by the new batch reading. This will provide you with a percentage value that indicates the difference in density values between the two batches of strips. Enter this value as your new K factor.

Example
The three unexposed test strips measured from the first batch produced an average reading of 1.60. The K factor was maintained at "1.00". When a second batch of test strips was purchased, three unexposed test strips were measured and produced a reading of 1.73. By dividing 1.60 by 1.73, a percentage value of .925 is obtained. This value is the difference between the two batches. Adjust the K factor to 0.925. With this new K factor, the new batch of strips will produce recalibrated density baseline of 1.62. This corresponds to the initial batch and will hold the subsequent values within acceptable error limits.

IMPORTANT: THE BASELINE OBTAINED FROM THE FIRST BATCH OF TEST STRIPS IS THE STANDARDIZED BASELINE FOR ALL SUBSEQUENT BATCHES. DO NOT LOSE THIS VALUE. ALL TEST STRIPS MUST BE CALIBRATED TO THIS VALUE.

3. Reproducibility and Measuring Accuracy
When establishing System repeatability, we determined mean values, double standard deviation, and error percentage. The error percentage is approximately 2% for test strips not exposed to radiation. This increases slightly following exposure, and varies slightly depending on dose strength.

To obtain a reliable result, perform at least three measuring sequences for each determination. This method minimizes possible deviations, and permits clear determination of the correct value. Direct comparison between exposed and non-exposed test strips is favorable for a more accurate evaluation of radiation tests.

Exposed and non-exposed tapes are measured one after the other, and the quotient E/E_0 is formed. This method recognizes and minimizes errors relating to layer thickness. The calibration curves (provided with each test strip batch) indicate the dependence of the extinction E as well as the dependence of the quotient E/Eo.

Magenta Test Strip 800 Specifications:

- Dose Levels: 0-1400 mJ/cm2;
- Range: 320-380nm
- Durability: Approx. 6 months
- Storage: Store in dark, cool environment; refrigeration not required
- Packaging: Quantities of 100

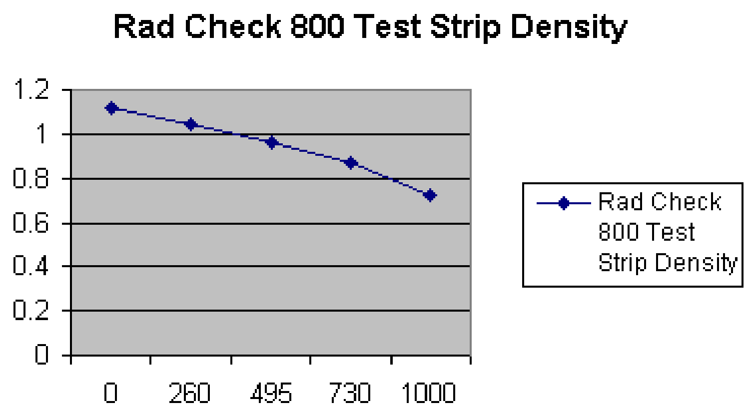
Dosimeter Specifications:

- Light source: 12V/6w commercial halogen lamp
- Sensor: UV-selective photodiode; max. rel. sensitivity: 320nm; 50% rel. sensitivity: 300-360nm

TROUBLESHOOTING

LCD Message	**Problem**	**Solution**
0.00 – CAL requested	Pressed OK button without any calibration.	Calibrate.
0.00 – CAL canceled	Pressed button other than CAL to stop calibration (the saved zero point is deleted.)	Repeat calibration sequence.
0.00 – CAL error	Density of calibration strip is too high (the saved zero point is deleted).	Repeat calibration with a different calibration strip.
0.00 – CAL error	UV sensor is not working properly.	Perform System Check. Problem may require sensor replacement.
Measure error 0.00 – CAL	Optical density of the measured test strip is lower than the density of the calibration strip.	Repeat calibration, then repeat measure.
Error! Low density! Strip not usable.	Optical density of the measured test strip is too low. Range of the sensing instrument has been exceeded.	Test strip exposure (or Irradiation) is too strong. If possible, reduce the power of the radiation unit or process the strip at a higher speed. If not, contact UV Process Supply.

RAD CHECK DOSIMETETER CORRELATION



The Rad Check system provides accurate and repeatable measurements of UV and EB dosages by producing linear results, as shown above. The UV results above were made by passing a Rad Check 800 test strip beneath a UV source at an average output of 120 w/cm.

The linear relationship exhibited between trials 1 and 6 shows that a simple formula can be used to convert Rad Check dosimeter values to UV dose in mJ/cm^2. The linear nature of the test strips hold for doses up to approximately 1400 mJ/cm^2.

For best results, the Rad Check data should be correlated with radiometer readings at the facility where it will be used. U V Process Supply, inc. provides this data as a demonstration of the effectiveness of the Rad Check system.

UV PROCESS SUPPLY, INC.

RAD CHECK 800 SYSTEM INSTRUCTION MANUAL

PART # M007-081

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