KERSHAW INSTRUMENTATION, LLC
PO BOX 163, 517 AUBURN AVENUE, SWEDESBORO, NJ 08085, 1-800-571-4657

NPIRI
Water Content Meter
MODEL 1B
OPERATING INSTRUCTIONS

KERSHAW INSTRUMENTATION, INC.

OPERATING INSTRUCTIONS

NPIRI WATER CONTENT METER

MODEL 1-B

1.0 SCOPE

The NPIRI Water Content Meter (NWCM) is designed to determine the water content of lithographic printing ink emulsions. However, it will also determine the water content of any liquid substance having a low dielectric constant compared to water.

2.0 CALIBRATION

The NWCM does not measure water content directly. It measure dielectric constant (DC) which is a function of the water content of fluids having a low DC. Calibration curves must be constructed by measuring the DC of inks containing known amounts of emulsified water. The procedure for preparing emulsions and construction calibration curves is shown in the Appendix. Tests performed with a variety of inks indicate that DC is related to vehicle composition. Inks having different vehicles will probably require separate (individual) calibration curves.

3.0 MEASUREMENT

3.1 Open the top lid of the NWCM by pushing the latch button on the front panel to the rear and lifting the lid.

3.2 Place one disposable plastic spacer in the large lower electrode and using a spatula, place 0.4cc of a representative sample of ink (about the size of a medium lima bean) in the center of the lower electrode. If the DC of the neat ink is 5.0 or greater, clean the electrodes and repeat the test using two spacers and 0.6cc of ink. The spacers must be aligned so that the spokes are directly over each other. When two spacers are used, double the DC reading when the circuit is balanced (needle in the center).

3.3 Place the lower electrode containing the sample of ink in the recessed area in the bottom plate of the NWCM.

3.4 Place the small upper electrode (with the conical recess on top) over the lower electrode so that it is approximately centered, and press down gently. The amount of ink should be sufficient to cover the surface of the upper electrode. The conical shape of the upper electrode will center the electrode and the spring in the lid will apply sufficient pressure to spread the ink between the electrodes.

3.5 Lower the lid until the latch snaps in place. Wait 2 minutes before taking a reading to allow the ink to spread evenly between the electrodes.

3.6 Balance the electric bridge by adjusting the two control knobs so as to position the needle of the meter at the center, or null point using the following procedures.

Step 1. Adjust the DL knob to its mid-point (50) on the dial.
Step 2. Adjust the DC control knob to position the needle close to the null point.
Step 3. Press the balance button and while keeping the balance button pressed down, adjust the control DL knob to move the needle closer to the null position.
Step 4. Repeat steps one and two as many times as needed to position the needle at the null point so that there is only a slight change in needle position when the balance switch is pressed and released.

3.7 Read the DC dial to the nearest tenth and determine the water content of the sample by reading the DC value from the applicable calibration curve.

4.0 CLEANING

Open the NWCM and remove the electrodes and ink sample. Separate the upper electrode from the lower electrode by gently prying it up with a screw driver. Discard the spacer and clean the electrodes in mineral spirits or a suitable cleaning solvent. Dry the electrodes before re-use.

5.0 ON-OFF

The NWCM does not have an on-off switch. Current is drawn only when the lid is down and the electrodes are in place. It is important not to have the lid down and latch with the electrodes in place for a long period of time. This will drain the batteries. The lid can be latched without the electrodes in place.

6.0 BATTERIES

The NWCM operates with four AA alkaline batteries. The batteries should last about one year with normal use.

KERSHAW INSTRUMENTATION, INC.

TROUBLE SHOOTING GUIDE

NPIRI WATER CONTENT METER

The comments that follow are intended to supplement the operating instructions for those functions that are critical to accuracy and repeatability.

SAMPLING

Air will normally become entrapped in the form of air bubbles when water and ink are mixed at high speeds. Using an ink sample that has trapped air will lead to low (and variable) dielectric constants. Air must be removed from the emulsified ink before it is measured. An effective technique is to spread a thin film of the ink over a glass plate using a gentle back and forth motion with a spatula. This will break the air bubbles without affecting the emulsion.

SAMPLE SIZE

Using a sample of ink that does not cover the entire surface of the upper electrode will result in low (and variable)dielectric constant readings. To insure that the sample size is large enough, some ink should appear in the annular space around the upper and lower electrodes. Since the electrodes are not visible when the lid is closed (and the measurement is being made), the operator should check to see that ink is present between the electrodes when the lid is opened. If ink is not present, repeat the test using a larger sample.

USING TWO SPACERS

For an ink sample that has a dielectric constant that exceeds 10.0, two spacers must be used, and the reading multiplied by 2.0. When two spacers are used, it is most important that the spokes for each spacer line up directly over each other. If the spokes are not lined-up, the space between the electrodes will not be double the space when one electrode is used. This would lead to a low DC reading.

TIME BEFORE MEASUREMENT

The time specified to wait before taking measurement (two minutes) should be long enough for most ink samples to flow out completely. However, a particularly short (stiff) ink may require more time. When this happens, the electrical bridge will be difficult to balance because the space between the electrodes is changing (becomes narrower) as the ink continues to flow. In those rare instances, wait 3 minutes before taking a reading.

APPENDIX: PREPARATION OF KNOWN EMULSIONS - CONSTRUCTION OF CALIBRATION CURVES FOR THE NPIRI WATER CONTENT METER

The following procedure is recommended to prepare emulsions of known concentrations of water, and to construct calibration curves.

A. EMULSION PREPARATION

(1) Weigh 100 grams of ink into a 8 oz. plastic, screw top jar having an I.D. of approximately 6.5 cm.

(2) Most lithographic inks made from flushes contain approximately 1.0 percent water as manufactured, but the concentration may vary between 0.5 to 2.0 percent. The assumption that the neat ink contains 1.0 percent water will not introduce a significant error, particularly at the higher water concentrations. However, if a higher degree of accuracy is desired, determine the water concentration of the neat ink by conducting a Karl Fisher, a Dean Stark, or equivalent test.

(3) Taking into account the initial concentration of water (1.0 percent or the determined amount) prepare 4.0 percent and 16.0 percent emulsions as follows:

(3a) Place the jar in an ice bath to limit the temperature increases while mixing.

(3b) The stirrer blade should be about two inches in diameter (5cm.) and of the Cowles type. This type of blade is available in most paint and hardware stores as a paint mixer for an electric drill. The blade should be positioned about 1/8 inch from the bottom of the jar.

(3c) Add the known amount of water to the ink and mix with a spatula until no visible water is present.

(3d) Increase the speed gradually and mix for five minutes at 1200 rpm using a tachometer to monitor the speed. Measure the temperature of the sample so as not to exceed 30° C.

(4) Seal tightly with a lid and label.

B. ALTERNATE METHOD

If a Kershaw Water Pickup System, Model WPS 101 is available the process can be stopped with an EC reading of 4 (4 percent). A second sample can be prepared with an EC reading of 16 (16 percent). This is a quick and accurate method to prepare the emulsions.

C. CALIBRATION CURVE

(1) Make DC measurements of the 4 and 16 percent emulsions by following the procedure in paragraph 3.0 of the operating instructions.

(2) Using appropriate graph paper, make a plot of water content, (horizontal axis) versus DC reading (vertical axis) for the 4 and 16 percent emulsions.

(3) Draw a straight line between the points. At extreme operating conditions, it was found that the water content of litho ink samples taken from the plate of a web press will vary between 4 and 16 percent. However, the calibration line can usually be extended to 20 percent if desired without introducing significant error.

(4) Label the calibration curve as to the type of ink and vehicle class.

(5) The water content of unknown samples of the same type of ink can now be determined by measuring the DC of the sample and reading the water content from the calibration curve of that ink. Experience may show that it is possible to use the same calibration curve for inks that are similar in composition provided the vehicles do not vary significantly in polarity.