

Kit Number 486900-W (Lead and Mercury)

# Ideal for Screening for Lead, Mercury, and Cadmium in Potable Water

(For Lead Soil Testing, see page 15)

# eXact® LEADQuick™

## Instruction Manual

**For use with eXact®  
LEADQuick™ Photometer**

U.S. Patent No. 7,333,194  
South African Patent  
# 2007/0628;  
EU Patent #1,725,864;  
and International Patent  
Appl. No. PCT/US2005  
/033985



486900-W

**Contains 50 Tests**

**For Your Safety:  
Please read the entire manual  
before using the test kit.**

This Instruction Manual does not include a test procedure for Lead in paint. Visit [www.sensafe.com](http://www.sensafe.com) for details.

**Manufactured by:  
Industrial Test Systems, Inc.  
[www.SENSAFE.com](http://www.SENSAFE.com)**

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| Parameter                | Page  | MENU |
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1

1

**PREPARE SAMPLE FOR TESTING**

Collect water sample in 50mL conical tube to the 50mL line. Add five (5) drops of **ACID-1 Reagent, Part No. 486999**. Mix and allow to sit for at least five (5) minutes. After this time, TEST SAMPLE is ready for testing.



2

2

**TURN METER ON**

Press the **ZERO/ON** button to power the meter on; the display will show all annunciators, then the current MENU selection, followed by the last reading.



3

3

**ADD SAMPLE TO CELL**

Using the TEST SAMPLE from above, fill and empty the **CELL** four (4) times. Finally, fill cell to capacity (4ml) with the TEST SAMPLE. Tilt meter forward to allow excess sample to flow out in order to make room for Pb-2 Reagent addition below.



4

5

**ADD REAGENT Pb-2**

Add five (5) drops of **eXact® Reagent Pb-2, Part No. 488375-B**.



5

6

**DIP STRIP AND PRESS "READ"**

Dip the **eXact® Strip Pb-3, Part No. 486997** into the **CELL** and immediately press **READ**. This starts the **20 SECOND** countdown timer. During this time move the strip in a gentle back and forth motion. **Remove and discard the strip after "1" on the display**  
The display will flash (- -) and begin immediately counting up from **1 to 60**. After the 60 seconds, the meter automatically zeros. The cursor will move across the display followed by **0 µg (µg/L)**.

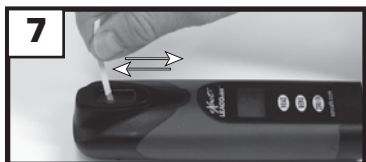


6

7

**DIP STRIP AND PRESS "READ"**

Dip the **eXact® Strip Pb-4, Part No. 486995** into the **CELL** and immediately press **READ**. This starts the **20 SECOND** countdown timer. During this time move the strip in a gentle back and forth motion. **Remove and discard the strip after "1" on the**  
The display will flash (- -) begin immediately counting up from **1 to 60**. After the 60 seconds, the cursor will move across the display, informing you that it is about to measure the sample as **µg (µg/L)**. Record result (this result is automatically stored in **PB2**). After testing is complete discard sample and rinse cell at least three times with clean water.



7

Uses Reagent Set 486901.



**1 PREPARE SAMPLE FOR TESTING**  
Collect water sample in 50mL conical tube to the 50mL line. Add three (3) drops of **ACID-1 Reagent, Part No. 486999**. Mix and allow to sit for at least five (5) minutes. After this time, TEST SAMPLE is ready for testing.



**2 TURN METER ON**  
Press the **ZERO/ON** button to power the meter on; the display will show all annunciators, then the current MENU selection, followed by the last reading.



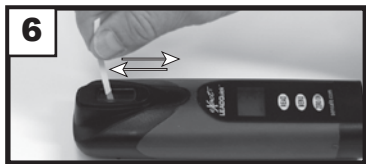
**3 SELECT TEST: HG3**  
Press and re-press the **MENU** button until the display shows the parameter HG3.



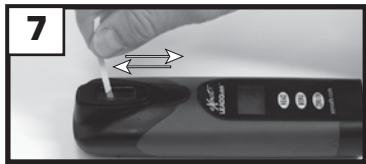
**4 ADD SAMPLE TO CELL**  
Using the TEST SAMPLE from above, fill and empty the **CELL** four (4) times. Finally, fill cell to capacity (4ml) with the TEST SAMPLE. Tilt meter forward to allow excess sample to flow out in order to make room for Pb-2 Reagent addition below.



**5 ADD REAGENT Pb-2**  
Add five (5) drops of **eXact® Reagent Pb-2, Part No. 488375-B**.



**6 DIP STRIP AND PRESS "READ"**  
Dip the **eXact® Strip Pb-3, Part No. 486997** into the **CELL** and immediately press **READ**. This starts the **20 SECOND** countdown timer. During this time move the strip in a gentle back and forth motion. **Remove and discard the strip after "1" on the display disappears.** The display will flash (- - -) and begin immediately counting up from **1 to 60**. After the 60 seconds, the meter automatically zeros. The cursor will move across the display followed by **0 µg (µg/L)**.



**7 DIP STRIP AND PRESS "READ"**  
Dip the **eXact® Strip Pb-4, Part No. 486995** into the **CELL** and immediately press **READ**. This starts the **20 SECOND** countdown timer. During this time move the strip in a gentle back and forth motion. **Remove and discard the strip after "1" on the display disappears.** The display will flash (- - -) and begin immediately counting up from **1 to 60**. After the 60 seconds, the cursor will move across the display, informing you that it is about to measure the sample as **µg (µg/L)**. Record result displayed (this result is automatically stored in HG3). After testing is complete discard sample and rinse cell at least three times with clean water.



- 1 PREPARE SAMPLE FOR TESTING**  
Collect water sample in 50mL conical tube to the 50mL line. Add five (5) drops of **HCl-1 Reagent, Part No. 486994**. Mix and allow to sit for five (5) minutes. After 5 minute wait, TEST SAMPLE is ready for testing.



- 2 TURN METER ON**  
Press the **ZERO/ON** button to power the meter on; the display will show all annunciators, then the current MENU selection, followed by the last reading.



- 3 SELECT TEST: CD4**  
Press and re-press the **MENU** button until the display shows the parameter CD4.



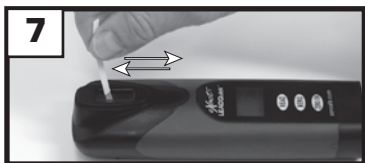
- 4 ADD SAMPLE TO CELL**  
Rinse the **CELL** at least 3 times with the TEST SAMPLE above. Finally, fill cell to capacity (4ml) with the TEST SAMPLE. Tilt meter forward to allow excess sample to flow out in order to make room for Pb-2 Reagent addition below.



- 5 ADD REAGENT Pb-2**  
Add five (5) drops of **eXact® Reagent Pb-2, Part No. 488375-B**.



- 6 DIP STRIP AND PRESS "READ"**  
Dip the **eXact® Strip Pb-3, Part No. 486996** into the **CELL** and immediately press **READ**. This starts the **20 SECOND** countdown timer. During this time move the strip in a gentle back and forth motion. **Remove and discard the strip after "1" on the display disappears.** The display will flash (- -) and begin immediately counting up from **1 to 240**. After the 240 seconds, the meter automatically zeros. The cursor will move across the display followed by **0.00 mg (mg/L)**.



- 7 DIP STRIP AND PRESS "READ"**  
Dip the **eXact® Strip Pb-4, Part No. 486995** into the **CELL** and immediately press **READ**. This starts the **20 SECOND** countdown timer. During this time move the strip in a gentle back and forth motion. **Remove and discard the strip after "1" on the display disappears.** The display will flash (- -) and begin immediately counting up from **1 to 240**. After the 240 seconds, the cursor will move across the display, informing you that it is about to measure the sample as **mg (mg/L)**. Record result displayed (this result is automatically stored in CD4). After testing is complete discard sample and rinse cell immediately.

# Spiked Recovery Test Method for Interferences:

The Spiked Recovery Test Method (also referred to as Standard Additions Method) is used to verify that LEADQuick™ gives accurate results for your water sample. If you find an unexplained difference in results when compared to another test method it is reasonable that you should resolve the issue. A good way to resolve the issue is by a technique commonly used by analytical chemists every day. This technique is often referred to as Spiked Recovery Test Method for Interferences. The following information explains how to perform the test method. You will need a Lead standard solution. The idea behind this method is as follows:

1. Add a known amount or concentration of Lead standard solution to the questionable sample. This is now the "spiked sample." It is recommended to add a Standard Solution amount that is at least equivalent to three times the minimum detectable limit of the test (10 µg/L or ppb).
2. Test the spiked and un-spiked (original) samples using the same reagents, instrument and technique or test method. The spiked sample should show an increase equal to the amount of standard added. The value obtained is called the **Recovery**. Ideally the % recovery is 100%. Results are acceptable if the % recovery is +/- 10%. The formula for calculating percent Recovery is below.
3. If the percent recovery is not in the acceptable range there may be interferences. You can consider diluting the sample with lead free water past the point of interference, within the detection limit of the test kit. You can also consider calculating the actual lead in the sample (see below) as long as the % Recovery is above a reasonable level such as 40%.

The percent recovery formula is as follows:

$$\% \text{ Recovery} = \frac{100(cs-cu)}{k}$$

Where:

cs = concentration found through testing of the spiked sample

cu = concentration found through testing of the un-spiked sample

(NOTE: result should be adjusted for the dilution of the spike volume if volume change is more than 5%)

k = concentration of the spike added to the sample

**Example 1:** An un-spiked questionable sample measures 10 ppb Lead. A separate 10 mL portion of the questionable sample was spiked by adding 20 µL of a 10 ppm Lead standard solution. This is the equivalent of adding 20 ppb Lead to the water sample. The spiked solution was measured by the same method as the original sample. The Spiked result was 28 ppb (Cs)

cs = 28 ppb

cu = 10 ppb

k = 20 ppb

$$\% \text{ Recovery} = \frac{100(28-10)}{20} = 90\% \quad (\text{Recovery result acceptable})$$

**Example 2:** In another water sample using a similar spiked method as in Example 1 the results were

cs = 30 ppb

cu = 18 ppb

k = 20 ppb

$$\% \text{ Recovery} = \frac{100(30-18)}{20} = 60\% \quad (\text{Recovery result unacceptable})$$

**Calculating the Lead:** In this example the percent recovery value is low and suggests that, with this test, the water sample gives lead results that are 60% of the actual concentration. To calculate the concentration of lead in this sample divide the expected recovery (100%) by the observed recovery (60%) to get the interference correction factor (100% / 60% = 1.67). Multiply the interference correction factor by the un-spiked sample result (cu) for the actual concentration of lead in the sample (1.67 x 18 ppb = 30 ppb).

# eXact® LEADQuick Tips For Best Accuracy

1. Become familiar with the meter and the different tests by reading the instructions carefully.
2. Observe the dip time (*as required for the test*) for accurate results.
3. Be sure the **CELL** is filled to capacity (4ml). Then, tilt meter forward to discard about 0.2mL of the cell volume. This allows for the Pb-2 addition to be performed without overflowing the **CELL**.
4. Rinse the **CELL** with clean water immediately after completing the test. (*Some test reagents will stain or coat the CELL*)
5. It is recommended that the sample be allowed to sit for 5 minutes or longer in Step 1 to facilitate Acid reaction. Additional time would be recommended if the detection of solid Lead or Cadmium, containing particles, are of interest.
6. Store the meter and all test materials out of direct sunlight and away from chemical storage areas.
7. Minimize exposure of meter and test reagents to heat. Storage below 80°F (27°C) is recommended. **DO NOT REFRIGERATE TEST REAGENTS.**
8. Dry the outside of the meter when testing is complete or before storage of the meter.
9. Each eXact® Strip Micro is valid for **ONLY** one test. Discard strip after single use in regular trash that is inaccessible to children and pets.
10. Each bottle of eXact® Strip Micro contains the quantity of strips notated on the bottle. Due to the manufacturing process, you may find one or two strips that are noticeably smaller or larger in width than the normal strips in the bottle. These should be discarded. Using these strips may give unreliable results.
11. If conversion table(s) are supplied, they have a unique revision number. It is recommended that you visit [www.sensafe.com](http://www.sensafe.com) to check for any updated revisions and details.
12. Tests are calibrated at 75°F +/- 2°F (24°C +/- 1°C). It is recommended that the water sample be warmed before testing if sample temperature is below 60°F / 16°C.
13. Our lab testing with the LEADQuick meter has shown that zeroing and measuring of the sample does not require any cell cover for accurate results, even in full sunlight.
14. Remove batteries when meter is not used for more than a month.

## Lead in Water Recommendation for "First Draw Sample"

The EPA 2007 Lead and Copper Rule Revision has a heavy lead testing focus on schools. The sampling is tiered:

1. "First draw sample" - sample a line unused for at least 8 to 18 hours. Draw the first 250mls to test. This measures the lead contribution from fixtures.
2. "Flushed sample" - before any water is used in the morning allow the line to run for 30 seconds, and then collect a 250ml sample. This measures the lead contribution from internal piping

The June 1991 Lead and Copper Rule Fact Sheet recommended 1 liter of water from a tap unused for 6 hours. This is not mentioned in the 2007 revisions to the rule.

The amount of flushing determines what part of the system is being evaluated for lead. If the volume of water in the system can be determined (e.g. gallons of water/linear ft. of pipe) the amount of flushing can help isolate the source of the lead contamination. It appears that this approach is used by some cities as they do mandated lead testing of their water systems.

# Instrument Operation Summary

## Key Functions

| Key            | Description | Function  |
|----------------|-------------|---|
| <b>ZERO/ON</b> | ZERO/ON     | While meter is off, when pressed, this turns meter on. When meter is on, when pressed, this zeros meter.  |
| <b>READ</b>    | READ        | When pressed, this initiates countdown timing and count up timing as appropriate for the MENU test.   |
| <b>MENU</b>    | MENU        | When pressed and re-pressed, this advances the display to the next MENU test. When pressed and held down for two seconds (continue holding down), the instrument automatically retrieves the last 20 measurements in the MENU displayed. Beginning with the most recent measurement stored (20) through the oldest measurement stored (1). This recall is available for each MENU test. |

When there is a question about the quality of a ReagentStrip™, your test method, or the photometer you are using, then it is recommended to test the SYSTEM (reagent, you, and photometer) by using the appropriate READY SNAP™ solution.

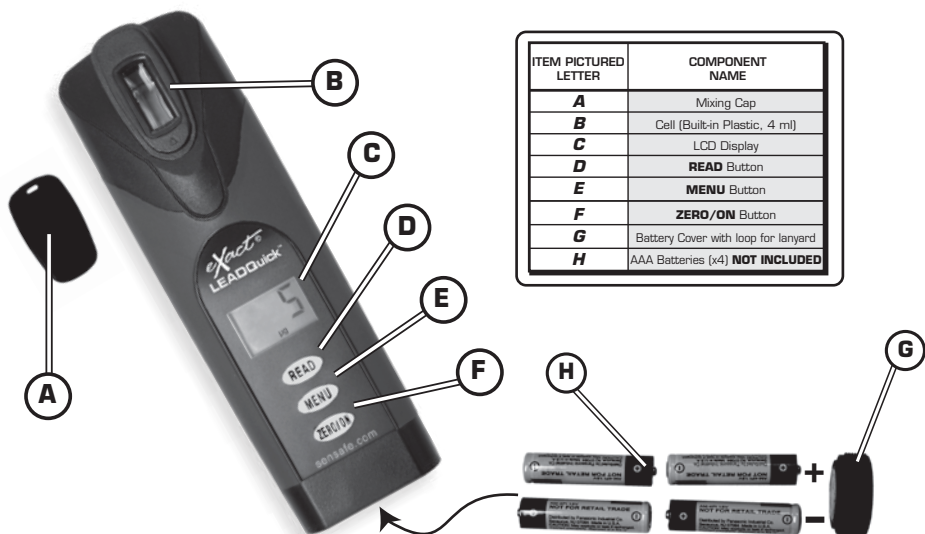
Follow the procedure below for the test you are running. If you get the acceptable result using the READY SNAP™ solution, then you can be confident that the reagent, you, and the photometer are working as a SYSTEM correctly.

## ReadySnap™ 1 Test Procedure

### Method Verification Solution for Testing

1. Snap off top of ReadySnap™ 1 vial safely and add one (1) drop of **Acid-1 (486999)** to Solution in ampoule.
2. Mix Solution by sucking up liquid with plastic pipette.
3. Turn on eXact® LEADQuick™ meter and scroll to PB2 MENU.
4. Using pipette, fill meter CELL with Solution and then empty cell.
5. Fill meter CELL again with Solution and tilt meter forward to make room for Pb-2 Reagent.
6. Add five drops of **Pb-2 Reagent (488375-B)**.
7. Dip **Pb-3 Strip (486997)** into cell and immediately push READ. Move strip in a gentle, back and forth motion (approx. 2 strokes/Sec) for 20 seconds. Remove strip after "1" on the display disappears.
8. Display will flash and automatically start to count up from 1 to 60. After the 60 seconds, meter automatically zeros.
9. Dip **Pb-4 Strip (486995)** into cell and immediately press READ. Move strip in a gentle, back and forth motion (approx. 2 strokes/Sec) for 20 seconds. Remove strip after "1" on the display disappears.
10. Display will flash and automatically count up from 1 to 60. After the 60 seconds, the cursor will move across display while the meter prepares to measure the sample. Record results displayed (this result is automatically stored in PB2 Menu).
11. After testing is completed, rinse CELL at least three times.

# eXact® LEADQuick Photometer



| ITEM PICTURED LETTER | COMPONENT NAME                         |
|----------------------|--|
| <b>A</b>             | Mixing Cap                             |
| <b>B</b>             | Cell (Built-in Plastic, 4 ml)          |
| <b>C</b>             | LCD Display                            |
| <b>D</b>             | <b>READ</b> Button                     |
| <b>E</b>             | <b>MENU</b> Button                     |
| <b>F</b>             | <b>ZERO/ON</b> Button                  |
| <b>G</b>             | Battery Cover with loop for lanyard    |
| <b>H</b>             | AAA Batteries (x4) <b>NOT INCLUDED</b> |

## eXact® LEADQuick™ Meter Specifications

|                                   |   |
|-----------------------------------|---|
| <b>Measurement Method:</b>        | Photometric   |
| <b>Light Source:</b>              | Light Emitting Diode (LED)                                  |
| <b>Wavelength:</b>                | 476 nm  |
| <b>ABS Range:</b>                 | .001 - 2.00   |
| <b>Photometric Precision:</b>     | .001  |
| <b>Automatic Range Selection:</b> | See Specifications below                                    |
| <b>Display:</b>                   | 3-digit customized liquid crystal display with annunciators |
| <b>CELL Pathlength:</b>           | 20mm  |

|  |   |
|--|---|
| <b>Cell Chamber:</b>                     | Custom-molded, proprietary, PET plastic fused into chamber; non-removable |
| <b>Sample Required:</b>                  | 4 ml (0.13 oz)  |
| <b>Operating Temperature Range:</b>      | 0 - 50°C (32° - 122°F)  |
| <b>Power Supply:</b>                     | (4) AAA alkaline batteries <b>Not Included</b>                            |
| <b>Battery Life:</b>                     | 2000 tests with alkaline batteries  |
| <b>Electromagnetic Compliance: (EMC)</b> | Emitted Interference - EN 61326<br>Immunity to Interference - EN 61326    |
| <b>Waterproof Rating:</b>                | Exceeds IP67  |
| <b>Weight:</b>                           | Instrument: 140 g (5 oz)  |
| <b>Dimensions:</b>                       | Instrument: 5 (W) x 3.5 (D) x 16.5 (H) cm;<br>(2 x 1.4 x 6.375 in)        |

## We offer a “Green” Alternative

eXact® LEADQuick has been designed to offer the user a more “Green” and cost-effective alternative to testing. Instead of using a 10ml water sample, eXact® LEADQuick uses a 4ml water sample, which uses up to 60% less chemical per test. The accuracy of the meter is maintained by designing the photo cell with a 20mm pathlength.

## eXact® LEADQuick™ Specifications


| Menu | Tests for                           | Range                            | Resolution     | +/- Accuracy       | Limit*                |
|------|-------------------------------------|----------------------------------|----------------|--------------------|-----------------------|
| PA1  | Diluted Homogenized Paint Lead      | .000 to 1.99                     | .001           | .003 or 6%         | —                     |
| PB2  | Lead in Water (auto-zero)           | 1 - 500 µg/L                     | 1 µg/L         | 3 µg/L or 6%       | 3 µg/L                |
| HG3  | Mercury in Water (auto-zero)        | 10 - 600 µg/L                    | 1 µg/L         | 6 µg/L or 6%       | 10 µg/L               |
| CD4  | Cadmium in Water (auto-zero)        | 0.01 - 0.80 mg/L                 | .01 mg/L       | .06 mg/L or 6%     | .02 mg/L              |
| AB5  | Future or Custom Tests (Absorbance) | .000 - 1.99<br>abs               | .001<br>abs    | .002 or 2%<br>abs  | —                     |
| PB6  | Lead in Water                       | 1 - 500 µg/L                     | 1 µg/L         | 3 µg/L or 6%       | 3 µg/L                |
| PB2  | Modified Test for Lead in Soil      | 18 - 3000 mg/kg<br>200 - 300,000 | 1 mg/kg<br>200 | + - 25%<br>+ - 40% | 18 mg/kg<br>200 mg/kg |
| PB2  | Lead extracted from Ceramic         | 1 - 500 µg/L                     | 1 µg/L         | 3 µg/L or 6%       | 3 µg/L                |

\*Limit is defined as the minimum reliable detection for that test. Any value below the limit should be considered inconclusive for that metal's presence.



## eXact® LEADQuick Meter Messages

The following are some common messages that may be displayed, including error messages. If an error message other than those listed below is displayed, please contact technical support in the USA at (803) 329-0162 (ext. 0).

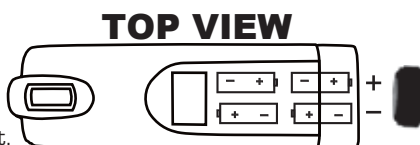
| LCD Message  | Description  | Corrective Action   |
|--|--|---|
| HI   | In READ mode: test sample concentration is above the measurement range (test specific).  | Dilute and retest. Dilution Kit available (Part Number 487200)  |
| LO   | In READ mode: test sample concentration is below the measurement range (test specific).  | Sample value is below measurement range.  |
| LO   | In ZERO mode: sample absorbance (due to a cloudy or colored sample or a dirty cell) is too high to zero, the meter will read "LO". | Dilute sample, filter sample, or clean cell. Testing cannot proceed until a valid ZERO is achieved.                               |
| ER   | Excessive stray light detected. Normally this does not occur, even when testing in sunlight.                                       | Place the LIGHT BLOCKING CAP over the CELL for zeroing and for reading result. Moving to a shaded area can also fix this problem. |
|  | Low battery indication.  | Replace the batteries.  |

### About The Built-In Cell

The built-in **CELL** is transparent plastic and, when filled to the top, contains 4ml. The sturdy **CELL** design will last for over 20,000 readings. Scratches on the **CELL** will not interfere or compromise the accuracy of the readings because of its fixed position. For best accuracy, rinse cell with clean water immediately after a test is completed. Do not use solvents, such as acetone, to clean the cell. When the **CELL** becomes stained or cloudy from repeated testing, or when the meter does not blank when you press the **ZERO/ON** button, the cell needs to be cleaned. Clean as follows: Fill cell with clean water and add two drops of Acid-1 or HCl-1. Leave meter undisturbed for 5 minutes. Afterwards, rinse the cell and the meter is ready for use again. Cleaning the cell regularly will not be necessary if you rinse the CELL immediately after the test.

### To Install/Replace "AAA" Batteries:

1. Unscrew the O-ring sealed battery cover counter-clockwise. Use proper sized pliers if necessary. Do not disturb the sealing O-ring. Batteries are not included.
2. Remove the used batteries and install 4 new AAA batteries following the diagram for correct polarity (see diagram). We recommend high quality AAA alkaline batteries be used.
4. Replace the battery cover. Be sure to tighten the cover securely. This is necessary for meter to be waterproof.
5. Dispose of the used batteries in accordance with your local regulations.
6. Press ZERO/ON button to confirm the meter turns on. The meter is now ready for operation.
7. Meter will not work if battery orientation is incorrect.



### eXact® Photometer 2-Year Limited Warranty

Registration of your eXact® photometer must be received within 30 days from date of purchase to activate the warranty. The eXact® photometer is warranted to be free from defects in materials and workmanship for a period of two (2) years from the date of purchase by the customer. ITS will repair or replace any part of the product which is deemed to be faulty or otherwise defective. The non-transferable warranty does not cover product damage caused by abuse (such as crushing a tablet in the cell) or improper use. If the meter is faulty or otherwise defective contact ITS by phone (+1-803-329-9712 Ext. 0) or email (its@sensafe.com) to describe the problem and obtain a return authorization form before returning the photometer to ITS. Damage caused by improper packing of the photometer for return shipment to ITS will not be covered by the warranty. Customer is responsible for shipping charges to ITS. ITS pays postage when photometer is returned to customer. A maximum processing fee of \$120 will be charged for repair or replacement of non-registered photometers and damages not covered by this warranty. Registration is available over the phone (+1-803-329-9712 Ext. 0) or online at <http://www.sensafe.com/micro/warranty/> (Personal data is kept confidential).

# Lead Recovery in Various Water Samples:

Our laboratory has performed numerous Spiked Recovery tests using water samples from around the world. The water samples were obtained in the locations as identified below. The water was collected in clean plastic bottles and shipped to our lab. The samples were not preserved by acid and not refrigerated.

Each sample was spiked in duplicate at two different spiked concentrations (20µg/L and 50µg/L) giving a total of four spiked tests. Except for two water samples the % recovery of spiked water samples had an acceptable average for the four spiked water tests (within +/- 10%). The Highland, NC well water averaged a 74% Recovery and the Seattle, WA municipal water averaged 83.5% Recovery.

Water sample lead (Pb<sup>+2</sup>) concentrations found for all samples were below 3ppb, and reported as 0, except for Rock Hill, SC water (exposed to lead).

|                                 |            | Water       | Spiked           |            | Spiked           |            |
|---------------------------------|------------|-------------|------------------|------------|------------------|------------|
| Water Origin                    | Water Type | Sample µg/L | 20ppb ppb (µg/L) | % Recovery | 50ppb ppb (µg/L) | % Recovery |
| Vienna, Austria                 | M          | 0           | 21               | 105        | 52               | 104        |
| repeated                        |            | 0           | 19               | 95         | 51               | 102        |
| Munich, Germany                 | M          | 0           | 21               | 105        | 54               | 108        |
| repeated                        |            | 0           | 19               | 95         | 46               | 92         |
| Kusnacht, Switzerland           | M          | 0           | 20               | 100        | 51               | 102        |
| repeated                        |            | 0           | 19               | 95         | 54               | 108        |
| Paris, France                   | M          | 0           | 19               | 95         | 50               | 100        |
| repeated                        |            | 0           | 20               | 100        | 45               | 90         |
| Washington, DC                  | M          | 0           | 23               | 119        | 52               | 104        |
| repeated                        |            | 0           | 20               | 100        | 49               | 98         |
| Philadelphia, PA                | M          | 0           | 17               | 85         | 45               | 90         |
| repeated                        |            | 0           | 23               | 119        | 43               | 86         |
| Phoenix, AZ                     | M          | 0           | 20               | 100        | 47               | 94         |
| repeated                        |            | 0           | 21               | 105        | 47               | 94         |
| Edgewater, MD                   | W          | 0           | 22               | 110        | 50               | 100        |
| repeated                        |            | 0           | 16               | 80         | 46               | 92         |
| Highland, NC                    | W          | 0           | 15               | 75         | 36               | 72         |
| repeated                        |            | 0           | 15               | 75         | 37               | 74         |
| Rockwell, NC                    | W          | 0           | 22               | 110        | 51               | 102        |
| repeated                        |            | 0           | 23               | 119        | 50               | 100        |
| Las Vegas, NV                   | M          | 0           | 19               | 95         | 52               | 104        |
| repeated                        |            | 0           | 17               | 85         | 49               | 98         |
| Chicago, IL                     | M          | 0           | 21               | 105        | 51               | 102        |
| repeated                        |            | 0           | 16               | 80         | 52               | 104        |
| Rock Hill, SC                   | W          | 0           | 18               | 90         | 47               | 94         |
| repeated                        |            | 0           | 17               | 85         | 46               | 92         |
| Melbourne, Australia            | M          | 0           | 20               | 100        | 47               | 94         |
| repeated                        |            | 0           | 19               | 95         | 45               | 90         |
| Rock Hill, SC (exposed to lead) | M          | 5           | 25               | 100        | 56               | 102        |
| repeated                        |            | 5           | 26               | 104        | 52               | 95         |
| Weaverville, NC                 | M          | 0           | 16               | 80         | 52               | 104        |
| repeated                        |            | 0           | 20               | 100        | 46               | 92         |
| Anaheim, CA                     | M          | 0           | 19               | 95         | 53               | 106        |
| repeated                        |            | 0           | 21               | 105        | 47               | 94         |
| Seattle, WA                     | M          | 0           | 16               | 80         | 45               | 90         |
| repeated                        |            | 0           | 16               | 80         | 42               | 84         |
| Kilowna, BC, Canada             | M          | 0           | 19               | 95         | 51               | 102        |
| repeated                        |            | 0           | 21               | 105        | 53               | 106        |

\*M = Municipal, W = Well

## Summary of LEADQuick™ Chemistry for Lead (Pb<sup>+2</sup>) Detection:

Lead in the water sample is first solubilized to Pb<sup>+2</sup> by the addition of the Nitric Acid reagent. Pb-2 Buffer is then added to make the solution alkali. The eXact® Strip Pb-3 is dipped for 20 seconds with gentle motion, which adds the porphyrin indicator, and mixes the solution. After a one minute wait, which allows for the porphyrin and Pb<sup>+2</sup> to form a colorimetric complex, the eXact® LEADQuick™ Colorimeter automatically zeros. The eXact® Strip Pb-4 is dipped into the cell sample for twenty seconds with gentle motion. This motion releases EDTA into the sample which then breaks up the colorimetric porphyrin-Pb<sup>2+</sup> complex. After a one minute wait, the result is displayed in µg (µg/L) as Lead. The Mercury test uses a similar chemistry. Cadmium uses Hydrochloric Acid for solubilization of the Cadmium ion, and this test requires more indicator reagent.

A procedure using the porphyrin 5,10,15,20-terakis(1-methylpyridinium-4-yl)porphine as indicator is described in Mirochim Acta volume 157, page 87-91 published in 2007 K. Kawamura, et al. For convenience the indicator is referred to as TMPYP. Our modified test procedure is patented. In combination with the eXact® Strip reagent delivery device, and by not removing the cell from the meter between the zeroing and reading steps; LEADQuick™ delivers optimum accuracy and sensitivity. Please refer to the Lead Test Interference chart (Table 1) for details as to the highest concentration of ions the test can tolerate. From our lab and contract lab studies with LEADQuick™ we find that over 90% of the typical potable, municipally treated water samples experience no interference. Before you start using the LEAD-Quick™ with potable water samples in your area use the "Standard Additions" method to determine if there are any interferences in your water that may require consideration.

Interfering ions listed, except for Mercury and Cadmium, inhibit the TMPYP-Pb<sup>+2</sup> complex formation above the concentrations given. Mercury and Cadmium give similar color reaction with TMPYP. Mercury is rarely found in tap water above 0.005 mg/L. A procedure modification is not yet available to remove Mercury interference. Typical Cadmium levels in tap water will not interfere in the Lead and Mercury procedures using Nitric Acid. Hardness ions such as Calcium and Magnesium are tolerated as noted in Table 1. When the water sample has Total Hardness minerals above 400 mg/L, the Pb-4 addition of EDTA may be inadequate; and the TMPYP-Pb<sup>+2</sup> complex may not be completely destroyed and the lead reading will be low. If you suspect this, do a Spiked Recovery Test (page 5).

It is recommended that for best results this test be done on unpreserved, freshly drawn water samples. Water samples that have been preserved with strong Nitric Acid for lead testing will require alkali neutralization of excess acid to a pH of about 2.5; and the Acid-1 addition can be skipped. After the Pb-2 addition step the pH should be verified if pH issue is a concern; and ideally should be between 9.0 and 9.6 pH.

A test kit is also available for detection of Lead in paint. Contact our Sales Department for details, or go to [www.sensafe.com](http://www.sensafe.com).

**Table 1:**

| <b>Lead Test (PB2 &amp; PB6 MENU) Interferences</b><br>(Similar interferences can be expected for Mercury and Cadmium Tests.) |                           |  |                           |
|---|---------------------------|--|---------------------------|
| <b>Ion</b>  | <b>Interference Level</b> | <b>Ion</b>                                       | <b>Interference Level</b> |
| Aluminum, Al <sup>3+</sup>  | 2 mg/L                    | Magnesium, Mg <sup>2+</sup>                      | 200 mg/L                  |
| Barium, Ba <sup>2+</sup>  | 3 mg/L                    | Manganese, Mn <sup>2+</sup>                      | 0.5 mg/L                  |
| Bromide, Br <sup>-</sup>  | 20 mg/L                   | Mercury, Hg <sup>2+</sup>                        | 0.01 mg/L                 |
| Cadmium, Cd <sup>2+</sup>   | 0.07 mg/L                 | Nickel, Ni <sup>2+</sup>                         | 1 mg/L                    |
| Calcium, Ca <sup>2+</sup>   | 500 mg/L                  | Nitrogen, Ammonium, NH <sub>4</sub> <sup>+</sup> | 40 mg/L                   |
| Chloride, Cl <sup>-</sup>   | 150 mg/L                  | Nitrogen, Nitrate, NO <sub>3</sub> <sup>-</sup>  | 20 mg/L                   |
| Chromium, Cr <sup>3+</sup>  | 0.1 mg/L                  | Nitrogen, Nitrite, NO <sub>2</sub> <sup>-</sup>  | 300mg/L                   |
| Cobalt, Co <sup>2+</sup>  | 1 mg/L                    | Phosphate, PO <sub>4</sub> <sup>3-</sup>         | 100 mg/L                  |
| Copper, Cu <sup>2+</sup>  | 5 mg/L                    | Sulfate, SO <sub>4</sub> <sup>2-</sup>           | 200 mg/L                  |
| Fluoride, F <sup>-</sup>  | 40 mg/L                   | Tin, Sn <sup>2+</sup>                            | 0.2 mg/L                  |
| Iron, Fe <sup>2+</sup>  | 0.2 mg/L                  | Zinc, Zn <sup>2+</sup>                           | 2 mg/L                    |
| Iron, Fe <sup>3+</sup>  | 0.1 mg/L                  |  | <b>Rev. 07/03/07</b>      |

## About your Water Sample:

If the water sample you are testing has a pH of 6.5 to 8.5, then the LEADQuick™ Reagent System will give valid results. If your water sample is below pH 6.5 or above pH 8.5, or has a Total Alkalinity above 200 PPM; then the pH of the water needs to be adjusted to between pH 7 and 8 before testing begins. Use 1.0N HCl or 1.0N NaOH to adjust the pH of your water sample. Iron above 0.1 ppm can be present in well water samples. It is recommended that the absence of iron be confirmed by the Iron Check Test (part number 480025). If your results are different from what you expect, then after the test is completed, check the pH of the reacted sample. The chemistry, to work properly, should have a final pH of 9.0 to 10.0. If your pH is below 9.0, then add six drops of PB-2 in step 5. If pH is above 10.0, then add four drops of PB-2 in step 5.

## Kit Specifications:

The test detects from 0 to 500 µg/L or ppb levels of Lead as Pb<sup>2+</sup>. The most accurate test range will be 3 to 200 µg/L. For this range, the Test resolution is 1 ppb, minimum detection is 3 µg/L, and accuracy is +/-3 µg/L or +/-6% (whichever is higher), when used with an eExact® LEADQuick™ Colorimeter. If lead level is above 500 µg/L (ppb), dilute sample with lead-free LEAD water before retesting.

The MCL (**M**aximum **C**ontaminant **L**evels allowed) for drinking water as set by the USEPA for Pb<sup>2+</sup> is 15 µg/L (WHO is 10 µg/L); Mercury (Hg<sup>+2</sup>) is 2 µg/L; and Cadmium (Cd<sup>+2</sup>) is 5 µg/L.

## MSDS 1

Material Safety Data Sheet

### Section 1 Chemical Identification

Catalog # / Description: Part Number 486999  
Name: eXact® Reagent Acid-1 (17 ml)

### Section 2 Composition / Information on Ingredients

CAS #: 7697-37-2 Nitric Acid ≈ 18%  
CAS#: 7732-18-5 Demineralized Water ≈ 82%  
Caution: CORROSIVE ingredient

### Section 3 Hazards Identification

Clear colorless liquid causes BURNS:

Eye contact: Causes eye burn

Skin Contact : Causes burn

Ingestion: Can cause acid burn including nausea, abdominal pain. Wear safety glasses with top and side shields and latex gloves when handling. Irritating to nose and throat. Avoid inhalation. Remove and wash contaminated clothing before reuse.

### Section 4 First-Aid Measures

- If swallowed, give 1-2 glasses of water. Call a physician or the Poison Control Center as a precaution.
- In case of skin contact, flush with copious amounts of water for at least 2 minutes. Remove contaminated clothing and shoes.
- In case of contact with eyes, flush with copious amounts of water for at least 15 minutes. Call physician.
- If inhaled, remove to fresh air. If breathing is difficult, give oxygen and seek medical advice.

### Section 5 Fire Fighting Measures

Not Flammable, but reacts with many metals forming hydrogen gas, which is flammable. Because of small volume in bottle, use media appropriate for surrounding fire conditions.

### Section 6 Exposure Controls / Personal Protection

Have an eyewash station nearby. Do not expose to eyes, skin, or clothing. Keep away from children and pets. Wash hands thoroughly after handling. Maintain general hygienic practices when using this product.

### Section 7 Physical and Chemical Properties

#### Appearance and Odor:

- Clear, colorless liquid with no odor

#### Physical Properties:

- Melting Point: Not Applicable
- Vapor Pressure: Not Applicable
- Specific Gravity: about 1.2
- Vapor Density: Not Available
- pH: < 0.6
- Stable when stored at room temperature.

#### Hazardous Polymerization:

- Will not occur.

### Section 8 Toxicological Information

- Ingredient toxicological data:
- Nitric acid oral Human LD<sub>50</sub>=430mg/kg
- Each bottle contains about 17 ml liquid
- HMIS and NFPA classification for Health: 3 and Reactivity: 1
- Wash hands after use and avoid skin, eye contact.
- This product may be shipped as part of a chemical test kit composed of various compatible components because of its small volume.

### Section 9 Other Information

The above information is believed to be correct but does not purport to be all-inclusive and shall be used ONLY as a guide. Keep away from children and pets.

## MSDS 2

Material Safety Data Sheet

### Section 1 Chemical Identification

Catalog # / Description: Part Number 488375-B  
Name: eXact® Reagent Pb-2 (15 ml)

### Section 2 Composition / Information on Ingredients

CAS#: 115-69-5 2-Amino-2-Methyl-1,3-Propanediol (AMP) 7%  
CAS# 77-86-1 Tris(hydroxymethyl)-aminomethane (TRIS) 15%  
CAS# 7732-18-5 Demineralized water 78%

### Section 3 Hazards Identification

- Physical Appearance: Clear, colorless liquid
- Immediate Concerns: DANGER. Alkali pH of around 10.8. Causes skin and eye burns. Wear safety glasses with top and side shields and latex gloves when handling. Irritating to nose and throat. Avoid inhalation. Remove and wash contaminated clothing before reuse.

### Section 4 First-Aid Measures

EYES: If contact with eyes occurs: Immediately flush eyes with water for 15 minutes. Call Physician.

SKIN: If contact with skin: Rinse off excess chemical and flush skin with soap and plenty of water. If skin irritation develops, seek medical attention.

INGESTION: If swallowed: Give 1-2 glasses of water. Do not induce vomiting. Never give anything by mouth to an unconscious person. Call a physician immediately.

### Section 5 Fire Fighting Measures

- This product is not flammable or combustible.
- Extinguishing Media: Use media appropriate for surrounding fire conditions

### Section 6 Exposure Controls / Personal Protection

Do not expose to eyes, skin, or clothing. Keep away from children and pets. Wash hands thoroughly after handling. Maintain general hygienic practices when using this product.

### Section 7 Physical and Chemical Properties

#### Appearance and Odor:

- Clear liquid.
- Odorless

#### Physical Properties:

- Melting Point: Not Applicable
- Vapor Pressure: Not Volatile
- Specific Gravity: about 1.4
- Vapor Density: Not determined

#### Stability:

- Stable when stored under proper conditions.

#### Hazardous Polymerization:

- Will not occur.

#### Incompatibilities:

- Incompatible with strong acids.

### Section 8 Toxicological Information

#### Acute Effects of ingredients:

- TRIS Oral LD<sub>50</sub>: 5,900 mg/kg (rat)
- AMP Oral LD<sub>50</sub>: 17,000 mg/kg (rats)

### Section 9 Other Information

The above information is believed to be correct but does not purport to be all-inclusive and shall be used ONLY as a guide. Keep away from children and pets.

## MSDS 3

Material Safety Data Sheet

**Section 1 Chemical Identification**  
Catalog # / Description: Part Number 486997  
Name: eXact® Strip Pb-3 (50)

**Section 2 Composition / Information on Ingredients**  
CAS #: 36951-72-1  
Chemical: meso-Tetra(N-methyl-4-pyridyl)prophine tetratosylate salt  
Trade name: TMPYP  
• Purple powder; Brown appearance on strip pad

**Section 3 Hazards Identification**  
Precautionary Statements:  
May be harmful by inhalation, ingestion and skin absorption. Causes eye and skin irritation.

**Section 4 First-Aid Measures**  
• Immediately flush eyes with plenty of water for 15 minutes. Call a physician.  
• If inhaled, remove to fresh air. If breathing is difficult, give oxygen and seek medical advice.  
• In case of contact, immediately wash skin with soap and water thoroughly.

**Section 5 Fire Fighting Measures**  
Fire/Explosion Hazard:  
• Fire may produce irritating or poisonous gases in small quantity  
Extinguishing Media:  
• Foam and water, Carbon Dioxide or dry chemical.

**Section 6 Exposure Controls / Personal Protection**  
Do not get in eyes, on skin, on clothing. Keep away from children and pets. Wash hands thoroughly after handling. Maintain general hygienic practices when using this product.

**Section 7 Physical and Chemical Properties**  
*Appearance and Odor:*  
• Solid bluish-gray powder  
*Physical Properties:*  
• Melting Point: >400°C  
• Vapor Pressure: Not Applicable  
• Specific Gravity: 1.98  
• Vapor Density: Not Applicable  
*Stability:*  
• Stable when stored dried and at room temperature.  
*Hazardous Polymerization:*  
• Will not occur.

**Section 8 Toxicological Information**  
• Skin and eye irritation.  
• LD50: None reported

**Section 9 Other Information**  
The above information is believed to be correct but does not purport to be all-inclusive and shall be used ONLY as a guide. Dispose of empty bottle and used test strip as normal trash. Keep away from children and pets. Store in a dry, cool place. Keep container tightly closed.

## MSDS 4

Material Safety Data Sheet

**Section 1 Chemical Identification**  
Catalog # / Description: Part Number 486995  
Name: eXact® Strip Pb-4 (50)

**Section 2 Composition / Information on Ingredients**  
CAS#: 64-02-8  
Chemical: EDTA Tetrasodium salt impregnated on strip pad pH adjusted to 10.5

**Section 3 Hazards Identification**  
Precautionary Statements:  
• May be irritating to eyes and nasal passages.  
• Low toxicity orally due to small amount in test pad  
• LD50: None reported.

**Section 4 First-Aid Measures**  
• If swallowed, give large quantities of water and call a physician or the Poison Control Center as a precaution.  
• In case of skin contact, flush with copious amounts of water.  
• In case of contact with eyes, flush with copious amounts of water for at least 15 minutes. Call physician.

**Section 5 Fire Fighting Measures**  
Not Applicable since the amount of Reagent in pad and kit is negligible.

**Section 6 Exposure Controls / Personal Protection**  
Do not expose to eyes, skin, or clothing. Keep away from children and pets. Wash hands thoroughly after handling. Maintain general hygienic practices when using this product.

**Section 7 Physical and Chemical Properties**  
*Appearance and Odor:*  
• White powder. Soluble in water.  
*Physical Properties:*  
• Melting Point: >300°C  
• Vapor Pressure: Not Applicable  
• Specific Gravity: Not Applicable  
• Vapor Density: Not Applicable  
*Stability:*  
• Stable when stored under proper conditions.  
*Hazardous Polymerization:*  
• Will not occur.  
*Incompatibilities:*  
• None reported.

**Section 8 Toxicological Information:**  
• LD50: None reported

**Section 9 Other Information**  
The above information is believed to be correct but does not purport to be all-inclusive and shall be used ONLY as a guide. Keep away from children and pets. Store in a dry, cool place. Keep container tightly closed.

# LEADQuick™ Method for Lead in Soil:

**Extraction Method** (Pb-1P, 0.1 ml scoop, and 50 ml Plastic Conical tube are not supplied, but required to perform this test)

Add one level scoop (0.1 ml volume scoop, which holds approximately 0.14 grams) of soil sample to a clean 50 ml, graduated, plastic conical tube. Add Twenty (20) drops of Pb-1P, Part No. 487925-P15 to the conical tube. Swirl the mixture for a few seconds or until all soil is suspended and mixed well. After five minutes, bring the volume of the sample to 50 ml using deionized, distilled, or lead free tap water. Cap and mix this solution. This solution is now identified as the Soil Extraction Solution (SES). Wait one (1) minute, or more, for suspended solids to settle, then perform the test as follows:

- 1 Add 1.0 ml (1000 µl) of SES sample to a clean 50 ml conical tube. Do not add **Pb-1P, Part No. 487925-P15** to the conical tube. Adjust the volume of the cell to 50 ml using lead free tap water. Mix sample. Test Sample is ready for testing.
- 2 Press the **ZERO/ON** button to power the meter on; the display will show all annunciators, then the current **MENU** selection, followed by the last reading.
- 3 Press and re-press the **MENU** button until the display shows the parameter **PB2**.
- 4 Rinse the **CELL** at least 3 times with the Test Sample above. Finally, fill cell to capacity (4ml) with the Test Sample. Tilt meter forward to allow excess sample to flow out in order to make room for **Pb-2** Reagent addition below.
- 5 Add five (5) drops of **eXact® Reagent Pb-2, Part No. 488375-B**.
- 6 Dip the **eXact® Strip Pb-3, Part No. 486997** into the **CELL** and immediately press **READ**. This starts the **20 SECOND** countdown timer. During this time move the strip in a gentle back and forth motion. **Remove and discard the strip after “1” on the display disappears**. The display will flash (- - -) and begin immediately counting up from 1 to 60. After the 60 seconds, the meter automatically zeros. The cursor will move across the display followed by 0 µg (µg/L).
- 7 Dip the **eXact® Strip Pb-4, Part No. 486995** into the **CELL** and immediately press **READ**. This starts the **20 SECOND** countdown timer. During this time move the strip in a gentle back and forth motion. **Remove and discard the strip after “1” on the display disappears**. The display will flash (- - -) and begin immediately counting up from 1 to 60. After the 60 seconds, the cursor will move across the display, informing you that it is about to measure the sample as µg (µg/L). Record result displayed (this result is automatically stored in **PB2**). After testing is complete discard sample and rinse cell immediately.
- 8 To convert the value in step 7 from µg/L to mg/kg use **17.86** as the multiplication factor: (For example: 65 µg/L × **17.86** = 1161 mg/kg)  
**NOTE:** If no Lead is found when 1.0 ml SES sample is used in Step 1, then try 2 ml of the SES for lower detection. If the result reads “HI”, then the SES sample should be retested using a 0.01 ml sample in Step 1. Pb-1P and Pb-2 drops required for these SES volume variations are listed in the chart below.

| SES Volume | Pb-1P Drops | Pb-2 Drops | Multiplication Factor | Range (mg/Kg) | Accuracy (%) |
|------------|-------------|------------|-----------------------|---------------|--------------|
| 0.01 ml    | 0           | 5          | 1786                  | up to 300,000 | ± 40         |
| 1 ml       | 0           | 5          | 17.86                 | 18 to 3000    | ± 25         |
| 2 ml       | 0           | 5          | 8.93                  | 18 to 1500    | ± 25         |

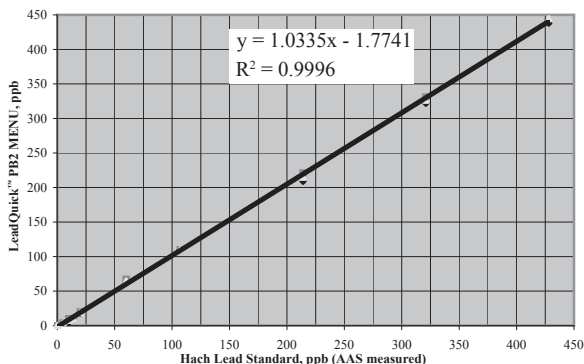
# eXact® LEADQuick™ Accuracy

Hach® Lead Standard Solution, 10 mg/L as Pb<sup>+2</sup> (Cat. 23748-20) was verified by Atomic Absorption and used with the eXact® LEADQuick™ Meter, PB2 MENU to confirm precision and accuracy.

| Hach®<br>AAS, Lead<br>Std, ppb | Meter 1<br>PB2 MENU<br>ppb | Meter 2<br>PB2 MENU<br>ppb | Average<br>PB2 MENU<br>ppb |
|--------------------------------|----------------------------|----------------------------|----------------------------|
| 0                              | 0                          | 0                          | 0                          |
| 5                              | 4                          | 4                          | 4                          |
| 10                             | 6                          | 10                         | 8                          |
| 10.7                           | 6                          | 10                         | 8                          |
| 14                             | 10                         | 10                         | 10                         |
| 20                             | 18                         | 20                         | 19                         |
| 60                             | 63                         | 67                         | 65                         |
| 107                            | 110                        | 110                        | 110                        |
| 214                            | 209                        | 221                        | 215                        |
| 321                            | 322                        | 331                        | 326.5                      |
| 428                            | 438                        | 451                        | 444.5                      |

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Detection of Lead in Water



## The eXact® LEADQuick Water Contents

(486901)

eXact® LEADQuick™  
Water Reagent Set

Includes:

- eXact Reagent ACID-1 (486999)
- eXact Reagent, PB-2 (488375-B)
- eXact Strip PB-3 (486997)
- eXact Strip PB-4 (486995)
- 50ml Conical Tube
- MSDS Sheet

## Contact Information

### For US Inquiries and Re-Orders: Industrial Test Systems, Inc.

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Rock Hill, SC 29730 USA  
Phone: 1-800-861-9712 - INSIDE THE U.S.  
1-803-329-9712 - OUTSIDE THE U.S.  
Fax: 1-803-329-9743

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