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You can read the recommendations in the user guide, the technical guide or the installation guide for HANNA INSTRUMENTS HI 83099. You'll find the answers to all your questions on the HANNA INSTRUMENTS HI 83099 in the user manual (information, specifications, safety advice, size, accessories, etc.). Detailed instructions for use are in the User's Guide.

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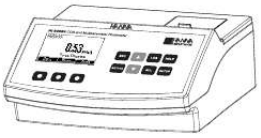
Instruction Manual

HI 83099

COD and Multiparameter Bench Photometer



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.. 135 All rights are reserved. Reproduction in whole or in part is prohibited without the written consent of the copyright owner, Hanna Instruments Inc., Woonsocket, Rhode Island, 02895 , USA. 2 PRELIMINARY EXAMINATION Please examine this product carefully. Make sure that the instrument is not damaged. If any damage occurred during shipment, please notify your local Hanna Office. Each meter is supplied complete with: · Four Sample Cuvettes and Caps · Sample Preparation Kit (for turbid or concentrated samples see page 17) · Cloth for wiping cuvettes (1 pcs) · 60 mL glass bottle for dissolved oxygen analysis (1 pcs) · Scissors · AC/DC Power Adapter · Instruction Manual The sample preparation kit contains: · 4 cuvettes (10 mL) with caps · 2 plastic beakers (100 and 170 mL) · 1 graduated cylinder (100 mL) · 1 syringe with screw rim (60 mL) · 1 syringe (5 mL) · 1 funnel · 25 filter discs · 1 spoon · 2 pipettes · Carbon powder packets (50 pcs) · 1 Demineralizer Bottle with filter cap for about 12 liters of deionized water (depending on the hardness level of water to be treated) Note: Save all packing material until you are sure that the instrument works correctly. Any defective item must be returned in its original packing with the supplied accessories.

GENERAL DESCRIPTION HI 83099 is a multiparameter bench photometer dedicated for Laboratory analysis. It measures 47 different methods using specific liquid or powder reagents. The amount of reagent is precisely dosed to ensure maximum reproducibility. HI 83099 bench photometer can be connected to a PC via an USB cable. The optional HI 92000 Windows ® Compatible Software helps users manage all their results.

HI 83099 has a powerful interactive user support that assists the user during the analysis process. Each step in the measurement process is help supported. A tutorial mode is available in the Setup Menu. 3 ABBREVIATIONS EPA: °C: °F: g/L: mg/L: g/L: mL: HR: MR: LR: PAN: TPTZ: US Environmental Protection Agency degree Celsius degree Fahrenheit micrograms per liter (ppb) milligrams per liter (ppm) grams per liter (ppt) milliliter high range medium range low range 1-(2-pyridylazo)-2-naphtol 2,4,6-tri-(2-pyridyl)-1,3,5-triazine SPECIFICATIONS Life of the instrument Silicon Photocell 0 to 50°C (32 to 122°F); max 90% RH non-condensing Power Supply external 12 Vdc power adapter built-in rechargeable battery Dimensions 235 x 200 x 110 mm (9.2 x 7.

87 x 4.33") Weight 0.9 Kg For specifications related to each method (e.g. range, resolution, etc.) refer to the related measurement section. Light Life Light Detector Environment PRECISION AND ACCURACY Precision is how closely repeated measurements agree with each other. Precision is usually expressed as standard deviation (SD). Accuracy is defined as the nearness of a test result to the true value. Although good precision suggests good accuracy, precise results can be inaccurate.

The figure explains these definitions. For each method, the accuracy is expressed in the related measurement section. 4 PRINCIPLE OF OPERATION Absorption of light is a typical phenomenon of interaction between electromagnetic radiation and matter. When a light beam crosses a substance, some of the radiation may be absorbed by atoms, molecules or crystal lattices. If pure absorption occurs, the fraction of light absorbed depends both on the optical path length through the matter and on the physical-chemical characteristics of substance according to the Lambert-Beer Law: -log I/Io = c d or A = c d Where: -log I/Io= Absorbance (A) Io = intensity of incident light beam I = intensity of light beam after absorption = molar extinction coefficient at wavelength c = molar concentration of the substance d = optical path through the substance Therefore, the concentration "c" can be calculated from the absorbance of the substance as the other factors are known. Photometric chemical analysis is based on the possibility to develop an absorbing compound from a specific chemical reaction between sample and reagents. Given that the absorption of a compound strictly depends on the wavelength of the incident light beam, a narrow spectral bandwidth should be selected as well as a proper central wavelength to optimize measurements. The optical system of HI 83099 is based on special subminiature tungsten lamps and narrow-band interference filters to guarantee both high performance and reliable results. Five measuring channels allow a wide range of tests. Instrument block diagram (optical layout) A microprocessor controlled special tungsten lamp emits radiation which is first optically conditioned and beamed through the sample contained in the cuvette.

The optical path is fixed by the diameter of the cuvette. Then the light is spectrally filtered to a narrow spectral bandwidth, to obtain a light beam of intensity Io or I. The photoelectric cell collects the radiation I that is not absorbed by the sample and converts it into an electric current, producing a potential in the mV range. The microprocessor uses this potential to convert the incoming value into the desired measuring unit and to display it on the LCD. 5 The measurement process is carried out in two phases: first the meter is zeroed and then the actual measurement is performed.

The cuvette has a very important role because it is an optical element and thus requires particular attention. It is important that both the measurement and the calibration (zeroing) cuvette are optically identical to provide the same measurement conditions. Most methods use the same cuvette for both, so it is important that measurements are taken at the same optical point. The instrument and the cuvette cap have special marks that must be aligned in order to obtain better reproducibility.

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The surface of the cuvette must be clean and not scratched.
This is to avoid measurement interference due to unwanted reflection and absorption of light. It is recommended not to touch the cuvette walls with hands. Furthermore, in order to maintain the same conditions during the zeroing and the measurement phases, it is necessary to cap the cuvette to prevent any contamination. FUNCTIONAL DESCRIPTION INSTRUMENT DESCRIPTION 6 1) 2) 3) 4) 5) 6) 7) 8) Open Cuvette Lid Indexing mark Cuvette point Liquid Crystal Display (LCD) Splash proof keypad ON/OFF power switch Power input connector USB connector KEYPAD DESCRIPTION The keypad contains 8 direct keys and 3 functional keys with the following functions: Press to perform the function displayed above it on the LCD. ESC Press to exit the current screen. Press to access the select method menu. Press to move up in a menu or a help screen, to increment a set value, to access second level functions. Press to move down in a menu or a help screen, to decrement a set value, to access second level functions. Press to log the current reading. RCL Press to recall the log.

Press to display the help screen. Press to access the setup screen. HELP SETUP 7 TIPS FOR AN ACCURATE MEASUREMENT The instructions listed below shoul the reaction times reported in this manual are at 25 °C (77 °F). In general, the reaction time should be increased for temperatures lower than 20 °C (68 °F), and decreased for temperatures higher than 25 °C (77 °F). INTERFERENCES · In the method measurement section the most common interferences that may be present in an average sample matrix have been reported. It may be that for a particular treatment process other compounds do interfere with the method of analysis. 10 HEALTH & SAFETY · The chemicals contained in the reagent kits may be hazardous if improperly handled. · Read the Material Safety Data Sheet (MSDS) before performing tests. · Safety equipment: Wear suitable eye protection and clothing when required, and follow instructions carefully. · Reagent spills: If a reagent spill occurs, wipe up immediately and rinse with plenty of water.
If reagent contacts skin, rinse the affected area thoroughly with water. Avoid breathing released vapors. · Waste disposal: for proper disposal of reagent kits and reacted samples, refer to the Material Safety Data Sheet (MSDS). METHOD REFERENCE TABLE Method 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 Method description Aluminum Alkalinity Ammonia MR Ammonia LR Bromine Calcium Free Chlorine Total Chlorine Chlorine Dioxide Chromium VI HR Chromium VI LR Color of Water Copper HR Copper LR Cyanuric Acid Fluoride Calcium Hardness Magnesium Hardness Hydrazine Iodine Iron HR Iron LR Magnesium Manganese HR Page 21 23 25 27 29 31 33 36 39 42 44 46 48 50 52 54 56 59 62 64 66 68 71 73 11 Method 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 Method description Manganese LR Molybdenum Nickel HR Nickel LR Nitrate Nitrite HR Nitrite LR Dissolved Oxygen COD HR COD MR COD LR Ozone pH Phosphate HR Phosphate LR Phosphorus Potassium HR Potassium MR Potassium LR Silica Silver Sulfate Zinc Page 75 78 81 83 86 88 90 92 94 97 100 103 106 108 110 112 114 116 118 120 122 125 127 OPERATIONAL GUIDE POWER CONNECTION AND BATTERY MANAGEMENT The meter can be powered from an AC/DC adapter (included) or from the built-in rechargeable battery. Note: Always turn the meter off before unplugging it to ensure no data is lost.
When the meter switches ON, it verifies if the power supply adapter is connected. The battery icon on the LCD will indicate the battery status: - battery is charging from external adapter - battery fully charged (meter connected to AC/DC adapter) - battery capacity (no external adapter) - battery Low (no external adapter) - battery Dead (no external adapter) METHOD SELECTION · Turn the instrument ON via the ON/OFF power switch. · The meter will perform an autodiagnostic test. During this test, the Hanna Instrument logo will appear on the LCD. After 5 seconds, if the test was successful, the last method used will appear on the display.
· In order to select the desired method press the METHOD key and a screen with the available methods will appear. · Press the keys to highlight the desired method. Press Select. 12 · After the desired method is selected, follow the measurement described in the related section. · Before performing a test you should read all the instructions carefully. DATA MANAGEMENT The instrument features a data log function to help you keep track of all your analysis. The data log can hold 200 individual measurements. Storing, viewing and deleting the data is possible using the LOG and RCL keys. . Storing data: You can store only a valid measurement.

Press LOG and the last valid measurement will be stored with date and time stamps. Viewing and deleting: You can view and delete the data log by pressing the RCL key. You can only delete the last saved measurement. Additionally, you can delete the data records all at once. CHEMICAL FORM Chemical form conversion factors are pre-programmed into the instrument and are method specific. In order to view the displayed result in the desired chemical form press or to access the second level function and then press the Chem Frm key to toggle between the available chemical forms for the selected method. SPECIAL CONVERSIONS For Magnesium and Calcium Hardness, special conversion factors can be used to convert the readings from mg/L to French degrees (°f), German degrees (°dH) and English degrees (°E) of hardness. This can be achieved by pressing or to access the second level functions and then press the Unit key to toggle between °f, °dH, °E and mg/L. 13 SETUP In the Setup mode the instrument's parameters can be changed. Some parameters affect the measuring sequence and others are general parameters that change the behavior or appearance of the instrument.
Press SETUP to enter the setup mode. Press ESC or SETUP to return to the main screen. A list of setup parameters will be displayed with currently configured settings. Press HELP for additional information. Press the keys to select a parameter and change the value as follows: Backlight Values: 0 to 8. Press the Modify key to access the backlight value. Use the functional keys or the keys to increase or decrease the value. Press the Accept functional key to confirm or ESC to return to the setup menu without saving the new value. Contrast Values: 0 to 20. This option is used to set the display's contrast. Press the Modify key to change the display's contrast. Use the functional keys or the keys to increase or decrease the value. Press the Accept key to confirm the value or ESC to return to the setup menu without saving the new value. 14 Date / Time This option is used to set the instrument's date and time.

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Press the Modify key to change the date/time. Press the functional keys to highlight the value to be modified (year, month, day, hour, minute or second). Use the keys to change the value. Press the Accept key to confirm or ESC to return to the setup without saving the new date or time. Time format Option: AM/PM or 24 hour. Press the functional key to select the desired time format.

Date format Press the Modify key to change the Date Format. Use the keys to select the desired format. Press Accept functional key to confirm or ESC to return to the setup menu without saving the new format. Language Press the corresponding key to change the language. If the new language cannot be loaded, the previously selected language will be reloaded. Tutorial Option: Enable or Disable. If enabled this option will provide the user short guide related to the current screen. Press the functional key to enable/disable the tutorial mode. Beeper Option: Enable or Disable. When enabled, a short beep is heard every time a key is pressed.

A long beep alert sounds when the pressed key is not active or an error is detected. Press the functional key to enable/disable the beeper. 15 Instrument ID Option: 0 to 9999. This option is used to set the instrument's ID (identification number). The instrument ID is used while exchanging data with a PC. Press the Modify key to access the instrument ID screen. Press the keys in order to set the desired value. Press the Accept key to confirm the value or ESC to return to the setup menu without saving the new value. Meter information Press the Select key to view the instrument model, firmware version, language version and instrument serial number. Press ESC to return to the Setup mode.

H E L P MODEE HELP M O D HI 83099 offers an interactive contextual help mode that assists the user at any time. To access the help screens press HELP. The instrument will display additional information related to the current screen. To read all the available information, scroll the text using the keys. Press the Support key to access a screen with Hanna service centers and their contact details. Press the Accessories key to access a list of instrument reagents and accessories. To exit support or accessories screens press ESC and the instrument will return to the previous help screen. To exit help mode press the HELP or ESC key again and the meter will return to the previously selected screen. 16 SAMPLE PREPARATION SAMPLE PREPARATION PROCEDURE The following Sample Preparation Procedure applies in case of: · Samples with color or suspended matter (turbidity). · Concentrated samples, for which the analysis result is over the range of the parameter.

Use the accessories contained in the Sample Preparation Kit to prepare the sample according to the following instructions. COLORED OR TURBID SAMPLES: Colored or suspended matter in large amounts may cause interference. They should be removed by treatment with active carbon and filtration. · If the water sample contains suspended matter, let it stand in a beaker until most of the solid particles have settled. Then, use the pipette to transfer the supernatant solution to the other beaker. To prevent the displacement of the settled solids at the bottom of the beaker, do not induce air bubbles into the solution. · Measure 100 mL of sample with the graduated cylinder. · If the solution still contains some turbidity or color, pour it in the large 170 mL beaker and add a powder packet of active carbon. · Mix well using the spoon and then wait for 5 minutes. · Fold a filter disc twice as shown in the figure. Separate one side from the other three to form a cone. Insert the folded filter disc in the funnel. 17 · Filter the treated sample into an empty beaker. The sample is now ready. · If the solution is still turbid or colored, treat it again with a packet of active carbon.

After use, throw the filter disc away and wash the syringe and the filter assembly well. Always use a new disc for another sample. CONCENTRATED SAMPLES: If the analysis result is over the method range, the sample should be diluted. The following procedure describe how to dilute the sample by a factor "N" (that is, to dilute by "N times"): · Use the graduated cylinder to measure exactly V mL of sample. For volumes V < 20 mL, accurately dose the sample by mean of the syringe.

Note: To measure exactly 5 mL of sample with the syringe, push the plunger completely into the syringe and insert the tip into the sample. Pull the plunger out until the lower edge of the seal is on the 5 mL mark of the syringe. probable level of liquid taken up by syringe 18 · Remove the cap and fill the Demineralizer Bottle with tap water. · Replace the cap and shake gently for at least 2 minutes. · Open the upper part of the Demineralizer Bottle cap and gently squirt the demineralized water into the cylinder, up to the 100 mL mark. Note: The ion exchange resin contained in the Demineralizer Bottle is provided with an indicator substance. The indicator will change from green to blue when the resin has been exhausted and needs to be replaced. · Pour the solution in the large 170 mL beaker, replace the cap and invert several times to mix. 19 · If the solution contains some turbidity or color, add a powder packet of active carbon and follow the procedure described in previous section Colored or Turbid Samples. · Calculate the dilution factor N: N = 100/V Where: V is the volume of original sample poured in the cylinder, expressed in mL, and 100 is the final volume in the cylinder, expressed in mL.

· When performing the reading, pay attention to multiply the read value by the dilution factor in order to obtain the real concentration of the analyte in the original sample: Example: Reading = value A Dilution factor = N Real value in the original sample = A x N Note: The methods Potassium Medium Range and Potassium High Range require a dilution of 1:5 (N = 5, V = 20 mL) and 1:10 (N = 10, V = 10 mL) of the sample. As the dilution is always done, it is already included in the final result and is not necessary to multiply by the dilution factor. 20 ALUMINUM SPECIFICATIONS Range Resolution Accuracy Typical EMC Deviation Light Source Method 0.00 to 1.00 mg/L 0.01 mg/L ±0.02 mg/L ±4% of reading at 25 °C ±0.01 mg/L Tungsten lamp with narrow band interference filter @ 525 nm Adaptation of the aluminon method. The reaction between aluminum and reagents causes a reddish tint in the sample. Description Ascorbic acid Aluminon reagent Bleaching powder Quantity 1 packet 1 packet 1 packet REQUIRED REAGENTS Code HI 93712A-0 HI 93712B-0 HI 93712C-0 REAGENT SETS HI 93712-01 Reagents for 100 tests HI 93712-03 Reagents for 300 tests For other accessories see page 132. MEASUREMENT PROCEDURE · Select the Aluminum method using the procedure described in the Method Selection section (see page 12).

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· Fill a graduated beaker with 50 mL of sample. · Add the content of one packet of HI 93712A-0 Ascorbic acid and mix until completely dissolved. · Add the content of one packet of HI 93712B-0 Aluminon reagent and mix until completely dissolved. This is the sample.
· Fill two cuvettes with 10 mL of sample each (up to the mark). 10 mL #1 10 mL #2 Aluminum 21 · Add the content of one packet of HI 93712C-0 Bleaching powder to one of the two cuvettes. Replace the cap and shake vigorously until completely dissolved. This is the blank. #1 · Place the blank into the holder and close the lid.
· Press Timer and the display will show the countdown prior to zeroing the blank. Alternatively wait for 15 minutes and then press Zero. The display will show "-0.0-" when the meter is zeroed and ready for measurement. #1 #2 · Remove the blank and insert the other cuvette into the instrument. · Press the Read key and the meter will perform the reading. The instrument displays the results in mg/L of aluminum. · Press or to access the second level functions. · Press the Chem Frm key to convert the result in mg/L of Al2O3. · Press or to return to the measurement screen.

INTERFERENCES Interference may be caused by: Iron above 20 mg/L, Alkalinity above 1000 mg/L, Phosphate above 50 mg/L; Fluoride must be absent. Aluminum 22 ALKALINITY SPECIFICATIONS Range Resolution Accuracy Typical EMC Deviation Light Source Method 0 to 500 mg/L (as CaCO3) 5 mg/L ±5 mg/L ±10 % of reading at 25 °C ±5 mg/L Tungsten lamp with narrow band interference filter @ 575 nm Colorimetric Method. The reaction causes a distinctive range of colors from yellow to green to greenish blue to develop. Description Alkalinity Indicator Reagent Quantity/test 1 packet REQUIRED REAGENTS Code HI 93755-0 REAGENT SETS HI 93755-01 Reagents for 100 tests HI 93755-03 Reagents for 300 tests For other accessories see page 132. MEASUREMENT PROCEDURE · Select the Alkalinity method using the procedure described in the Method Selection section (see page 12). 10 mL · Fill the cuvette with 10 mL of unreacted sample (up to the mark) and replace the cap. · Place the cuvette into the holder and close the lid · Press the Zero key. The display will show "-0.0-" when the meter is zeroed and ready for measurement. 23 Alkalinity · Remove the cuvette.
· Carefully add the content of one packet of HI 93755-0 Alkalinity Indicator Reagent. Replace the cap and shake vigorously for 30 seconds. Note: Pay attention not to spill reagent otherwise full color development may be inhibited. · Press Timer or wait for 2 minutes. Then invert 3 times the cuvette gently again.
· Reinsert the cuvette into the instrument and close the lid. · Press Read to start the reading. · The instrument displays the results in mg/L of alkalinity (CaCO3). Alkalinity 24 AMMONIA MEDIUM RANGE SPECIFICATIONS Range Resolution Accuracy Typical EMC Deviation Light Source Method 0.00 to 10.
00 mg/L 0.01 mg/L ±0.05 mg/L ±5% of reading at 25 °C ±0.01 mg/L Tungsten lamp with narrow band interference filter @ 420 nm Adaptation of the ASTM Manual of Water and Environmental Technology, D1426-92, Nessler method. The reaction between ammonia and reagents causes a yellow tint in the sample. Description First Reagent Second Reagent Quantity 4 drops (6 drops for seawater) 4 drops (10 drops for seawater) REQUIRED REAGENTS Code HI 93715A-0 HI 93715B-0 REAGENT SETS HI 93715-01 Reagents for 100 tests HI 93715-03 Reagents for 300 tests For other accessories see page 132. MEASUREMENT PROCEDURE · Select the Ammonia MR method using the procedure described in the Method Selection section (see page 12). · Fill the cuvette with 10 mL of unreacted sample (up to the mark) and replace the cap. 10 mL · Place the cuvette into the holder and close the lid. · Press the Zero key.

The display will show "-0.0-" when the meter is zeroed and ready for measurement. 25 Ammonia MR · Remove the cuvette. · Add 4 drops of HI 93715A-0 First Reagent (6 drops for seawater analysis). Replace the cap and mix the solution. · Add 4 drops of HI 93715B-0 Second Reagent (10 drops for seawater analysis). Replace the cap and mix the solution. · Reinsert the cuvette into the instrument. · Press Timer and the display will show the countdown prior to the measurement or, alternatively, wait for 3 minutes and 30 seconds and press Read. When the timer ends the meter will perform the reading.
The instrument displays the results in mg/L of ammonia nitrogen (NH3-N). · Press or to access the second level functions. · Press the Chem Frm key to convert the result in mg/L of ammonia (NH3) and ammonium (NH4+). · Press or to return to the measurement screen. INTERFERENCES Interference may be caused by: acetone, alcohols, aldehydes, glycine, hardness above 1 g/L, iron, organic chloramines, sulfide, various aliphatic and aromatic amines.
Ammonia MR 26 AMMONIA LOW RANGE SPECIFICATIONS Range Resolution Accuracy Typical EMC Deviation Light Source Method 0.00 to 3.00 mg/L 0.01 mg/L ±0.04 mg/L ±4% of reading at 25 °C ±0.
01 mg/L Tungsten lamp with narrow band interference filter @ 420 nm Adaptation of the ASTM Manual of Water and Environmental Technology, D1426-92, Nessler method. The reaction between ammonia and reagents causes a yellow tint in the sample. Description First Reagent Second Reagent Quantity 4 drops (6 drops for seawater) 4 drops (10 drops for seawater) REQUIRED REAGENTS Code HI 93700A-0 HI 93700B-0 REAGENT SETS HI 93700-01 Reagents for 100 tests HI 93700-03 Reagents for 300 tests For other accessories see page 132. MEASUREMENT PROCEDURE · Select the Ammonia LR method using the procedure described in the Method Selection section (see page 12). · Fill the cuvette with 10 mL of unreacted sample (up to the mark) and replace the cap. 10 mL · Place the cuvette into the holder and close the lid. · Press the Zero key. The display will show "-0.0-" when the meter is zeroed and ready for measurement. 27 Ammonia LR · Remove the cuvette.

· Add 4 drops of HI 93700A-0 First Reagent (6 drops for seawater analysis). Replace the cap and mix the solution. · Add 4 drops of HI 93700B-0 Second Reagent (10 drops for seawater analysis). Replace the cap and mix the solution. · Reinsert the cuvette into the instrument. · Press Timer and the display will show the countdown prior to the measurement or, alternatively, wait for 3 minutes and 30 seconds and press Read. When the timer ends the meter will perform the reading. The instrument displays the results in mg/L of ammonia nitrogen (NH3-N).

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· Press or to access the second level functions. · Press the Chem Frm key to convert the result in mg/L of ammonia (NH3) and ammonium (NH4+).
· Press or to return to the measurement screen. INTERFERENCES Interference may be caused by: acetone, alcohols, aldehydes, glycine, hardness above 1 g/L, iron, organic chloramines, sulfide, various aliphatic and aromatic amines. Ammonia LR 28 BROMINE SPECIFICATIONS Range Resolution Accuracy Typical EMC Deviation Light Source Method 0.00 to 8.00 mg/L 0.
01 mg/L ±0.08 mg/L ±3% of reading at 25 °C ±0.01 mg/L Tungsten lamp with narrow band interference filter @ 525 nm Adaptation of the Standard Methods for the Examination of Water and Wastewater, 18th edition, DPD method. The reaction between bromine and the reagent causes a pink tint in the sample. Description DPD Reagent Quantity 1 packet REQUIRED REAGENTS Code HI 93716-0 REAGENT SETS HI 93716-01 Reagents for 100 tests HI 93716-03 Reagents for 300 tests For other accessories see page 132.
MEASUREMENT PROCEDURE · Select the Bromine method using the procedure described in the Method Selection section (see page 12). 10 mL · Fill the cuvette with 10 mL of unreacted sample (up to the mark) and replace the cap. · Place the cuvette into the holder and close the lid. · Press the Zero key. The display will show "-0.0-" when the meter is zeroed and ready for measurement. 29 Bromine · Remove the cuvette and add the content of one packet of HI 93716-0 DPD reagent. Replace the cap and shake gently for about 20 seconds to dissolve most of the reagent. · Reinsert the cuvette into the instrument. · Press Timer and the display will show the countdown prior to the measurement or, alternatively, wait for 2 minutes and 30 seconds and press Read.

When the timer ends the meter will perform the reading. · The instrument displays the results in mg/L of bromine. INTERFERENCES Interference may be caused by: Chlorine, Iodine, Ozone, Oxidized forms of Chromium and Manganese. In case of water with hardness greater than 500 mg/L CaCO3, shake the sample for approximately 2 minutes after adding the reagent. In case of water with alkalinity greater than 250 mg/L CaCO3 or acidity greater than 150 mg/L CaCO3, the color of the sample may develop only partially, or may rapidly fade. To resolve this, neutralize the sample with diluted HCl or NaOH. Bromine 30 CALCIUM SPECIFICATIONS Range Resolution Accuracy Light Source Method Code HI 93752A-0 Ca HI 93752B-0 Ca 0 to 400 mg/L 10 mg/L ±10 mg/L ±5% of reading at 25 °C Tungsten lamp with narrow band interference filter @ 466 nm Adaptation of the Oxalate method. Description Buffer Reagent Calcium Buffer Reagent Calcium Oxalate Reagent Quantity 4 drops 7 mL 1 mL REQUIRED REAGENTS REAGENT SETS HI 937521-01 Reagents for 50 tests HI 937521-03 Reagents for 150 tests For other accessories see page 132. MEASUREMENT PROCEDURE Note: for sample preparation follow the COLORED OR TURBID SAMPLES procedure at page 17. · Select the Calcium method using the procedure described in the Method Selection section (see page 12).
· Using the 5 mL syringe add exactly 3.00 mL of sample to the cuvette. 3 mL of sample · Use the pipette to fill the cuvette up to the 10 mL mark with the HI 93752A-0 Calcium Buffer Reagent. · Add 4 drops of Buffer Reagent. 31 Calcium · Replace the cap and invert several times to mix.
· Place the cuvette into the holder and close the lid. · Press the Zero key. The display will show "-0.0-" when the meter is zeroed and ready for measurement. · Remove the cuvette.
· Using the 1 mL syringe, add exactly 1 mL of the HI 93752B-0 Calcium Oxalate Reagent. Replace the cap and invert the cuvette 10 times to mix (about 15 seconds). · Press Timer or wait for 5 minutes. Then invert again the cuvette 10 times to mix (about 15 seconds). · Reinsert the cuvette into the instrument. · Press Read to start the reading. The instrument displays the results in mg/L of Calcium. INTERFERENCES: Interferences may be caused by: Acidity (as CaCO3) above 1000 mg/L Alkalinity (as CaCO3) above 1000 mg/L Magnesium (Mg2+) above 400 mg/L Calcium 32 FREE CHLORINE FREE CHLORINE SPECIFICATIONS Range Resolution Accuracy Typical EMC Deviation Light Source Method 0.00 to 2.50 mg/L 0.

01 mg/L ±0.03 mg/L ±3% of reading at 25 °C ±0.01 mg/L Tungsten lamp with narrow band interference filter @ 525 nm Adaptation of the EPA DPD method 330.5. The reaction between free chlorine and the DPD reagent causes a pink tint in the sample. REQUIRED REAGENTS POWDER: Code HI 93701-0 LIQUID: Code HI 93701A-F HI 93701B-F Description DPD Description DPD1 Indicator DPD1 Buffer Quantity 1 packet Quantity 3 drops 3 drops REAGENT SETS HI 93701-F Reagents for 300 tests (liquid) HI 93701-01 Reagents for 100 tests (powder) HI 93701-03 Reagents for 300 tests (powder) For other accessories see page 132. MEASUREMENT PROCEDURE · Select the Free Chlorine method using the procedure described in the Method Selection section (see page 12). · Fill the cuvette with 10 mL of unreacted sample (up to the mark) and replace the cap. 10 mL · Place the cuvette into the holder and close the lid. 33 Free Chlorine · Press the Zero key.
The meter will show "-0.0-" when the meter is zeroed and ready for measurement. · Remove the cuvette. Powder reagents procedure · Add the content of one packet of HI 93701 DPD reagent. Replace the cap and shake gently for 20 seconds (or 2 minutes for seawater analysis).
· Reinsert the cuvette into the instrument. · Press Timer and the display will show the countdown prior to the measurement or, alternatively, wait for 1 minute and press Read. When the timer ends the meter will perform the reading. The instrument displays the results in mg/L of free chlorine. Liquid reagents procedure · To an empty cuvette add 3 drops of HI 93701A-F DPD1 indicator and 3 drops of HI 93701B-F DPD1 buffer.
Swirl gently to mix, and immediately add 10 mL of unreacted sample. Replace the cap and shake gently again. Free Chlorine 34 · Place the cuvette into the instrument. · Press Read to start the reading. The instrument displays the results in mg/L of free chlorine. INTERFERENCES Interference may be caused by: Bromine, Iodine, Ozone, Oxidized forms of Chromium and Manganese. In case of water with hardness greater than 500 mg/L CaCO3, shake the sample for approximately 2 minutes after adding the powder reagent. In case of water with alkalinity greater than 250 mg/L CaCO3 or acidity greater than 150 mg/L CaCO3, the color of the sample may develop only partially, or may rapidly fade. To resolve this, neutralize the sample with diluted HCl or NaOH.

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35 Free Chlorine TOTAL CHLORINE SPECIFICATIONS Range Resolution Accuracy Typical EMC Deviation Light Source Method 0.

00 to 3.50 mg/L 0.01 mg/L ±0.03 mg/L ±3% of reading at 25 °C ±0.01 mg/L Tungsten lamp with narrow band interference filter @ 525 nm Adaptation of the EPA DPD method 330.5. The reaction between the chlorine and the DPD reagent causes a pink tint in the sample. REQUIRED REAGENTS POWDER: Code HI 93711-0 LIQUID: Code HI 93701A-T HI 93701B-T HI 93701C Description DPD Description DPD1 indicator DPD1 buffer DPD3 solution Quantity 1 packet Quantity 3 drops 3 drops 1 drop REAGENT SETS HI 93701-T Reagents for 300 total chlorine tests (liquid) HI 93711-01 Reagents for 100 total chlorine tests (powder) HI 93711-03 Reagents for 300 total chlorine tests (powder) For other accessories see page 132. MEASUREMENT PROCEDURE · Select the Total Chlorine method using the procedure described in the Method Selection section (see page 12). 10 mL · Fill the cuvette with 10 mL of unreacted sample (up to the mark) and replace the cap.

· Place the cuvette into the holder and close the lid. Total Chlorine 36 · Press the Zero key. The meter will show "-0.0-" when the meter is zeroed and ready for measurement. · Remove the cuvette.

Powder reagents procedure · Add 1 packet of HI 93711 DPD reagent. Replace the cap and shake gently for 20 seconds (or 2 minutes for seawater analysis). · Reinsert the cuvette into the instrument. · Press Timer and the display will show the countdown prior to the measurement or, alternatively, wait for 2 minutes and 30 seconds and press Read. When the timer ends the meter will perform the reading.

The instrument displays the results in mg/L of total chlorine. Liquid reagents procedure · To an empty cuvette add 3 drops of HI 93701A-T DPD1 indicator, 3 drops of HI 93701B-T DPD1 buffer and 1 drop of HI 93701C DPD3 solution. Swirl gently to mix and immediately add 10 mL of unreacted sample. Replace the cap and shake gently again. · Reinsert the cuvette into the instrument. 37 Total Chlorine · Press Timer and the display will show the countdown prior to the measurement or, alternatively, wait for 2 minutes and 30 seconds and press Read. When the timer ends the meter will perform the reading. · The instrument displays the results in mg/L of total chlorine. Note: free and total chlorine have to be measured separately with fresh unreacted samples following the related procedure if both values are requested. INTERFERENCES Interference may be caused by: Bromine, Iodine, Ozone, Oxidized forms of Chromium and Manganese.

In case of water with hardness greater than 500 mg/L CaCO3, shake the sample for approximately 2 minutes after adding the powder reagent. In case of water with alkalinity greater than 250 mg/L CaCO3 or acidity greater than 150 mg/L CaCO3, the color of the sample may develop only partially, or may rapidly fade. To resolve this, neutralize the sample with diluted HCl or NaOH. Total Chlorine 38 CHLORINE DIOXIDE SPECIFICATIONS Range Resolution Accuracy Typical EMC Deviation Light Source Method 0.00 to 2.00 mg/L 0.01 mg/L ±0.10 mg/L ±5% of reading at 25 °C ±0.01 mg/L Tungsten lamp with narrow band interference filter @ 575 nm Adaptation of the Chlorophenol Red method. The reaction between chlorine dioxide and reagents causes a colorless to purple tint in the sample.

Description Reagent A Dechlorinating Reagent B Reagent C Reagent D Quantity 1 mL 1 packet 1 mL 1 mL REQUIRED REAGENT Code HI 93738A-0 HI 93738B-0 HI 93738C-0 HI 93738D-0 REAGENT SETS HI 93738-01 Reagents for 100 tests HI 93738-03 Reagents for 300 tests For other accessories see page 132. MEASUREMENT PROCEDURE · Select the Chlorine Dioxide method using the procedure described in the Method Selection section (see page 12). · Fill two graduated mixing cylinders (# 1 & # 2) up to the 25 mL mark with the sample. #1 25 mL #2 25 mL · Add 0.5 mL of HI 93738A-0 Chlorine Dioxide Reagent to each cylinder (# 1 & # 2), close them and invert several times to mix.

#1&#2 #1 #2 39 Chlorine Dioxide · Add the content of one packet of HI 93738B-0 Dechlorinating Reagent to one of the two cylinders (# 1), close and invert it several times until it is totally dissolved. This is the blank. #1 · Add precisely 0.5 mL of HI 93738C-0 Chlorine Dioxide Reagent to each cylinder (# 1 & # 2), close them and invert several times to mix. #1&#2 #1 #2 · Add 0.

5 mL of HI 93738D-0 Chlorine Dioxide Reagent to each cylinder (# 1 & # 2), close them and invert several times to mix. Cylinder # 2 is the reacted sample. #1&#2 #1 #2 #1 10 mL · Fill a cuvette with 10 mL of the blank (# 1) up to the mark and replace the cap. · Place the blank (# 1) into the holder and close the lid. #1 Chlorine Dioxide 40 · Press the Zero key. The meter will show "-0.0-" when the meter is zeroed and ready for measurement. · Fill another cuvette with 10 mL of the reacted sample (# 2) up to the mark and replace the cap. #2 10 mL #2 · Insert the sample into the instrument. · Press Read and the meter will perform the reading.

The instrument displays the results in mg/L of chlorine dioxide. SAMPLING PROCEDURE It is recommended to analyze chlorine dioxide samples immediately after collection. Chlorine dioxide samples must be stored in sealed dark glass bottle, with minimal head space. Excessive heat (above 25°C/78°F), agitation and exposure to light must be avoided. INTERFERENCES Interferences may be caused by strong oxidants. 41 Chlorine Dioxide CHROMIUM VI HIGH RANGE SPECIFICATIONS Range Resolution Accuracy Typical EMC Deviation Light Source Method 0 to 1000 g/L 1 g/L ±5 g/L ±4% of reading at 25 °C ±1 g/L Tungsten lamp with narrow band interference filter @ 525 nm Adaptation of the ASTM Manual of Water and Environmental Technology, D1687-92, Diphenylcarbohydrazide method. The reaction between chromium VI and the reagent causes a purple tint in the sample. Description Powder reagent Quantity 1 packet REQUIRED REAGENTS Code HI 93723-0 REAGENT SETS HI 93723-01 Reagents for 100 tests HI 93723-03 Reagents for 300 tests For other accessories see page 132. MEASUREMENT PROCEDURE · Select the Chromium VI HR method using the procedure described in the Method Selection section (see page 12). · Fill the cuvette with 10 mL of unreacted sample (up to the mark) and replace the cap.

· Place the cuvette into the holder and close the lid. 10 mL · Press the Zero key. The meter will show "-0.0-" when the meter is zeroed and ready for measurement. · Remove the cuvette and add the content of one packet of HI 93723-0 reagent.

Replace the cap and shake vigorously for about 10 seconds.

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Chromium VI HR 42 · Reinsert the cuvette into the instrument. · Press Timer and the display will show the countdown prior to the measurement or, alternatively, wait for 6 minutes and press Read. When the timer ends the meter will perform the reading. The instrument displays concentration in g/L of chromium VI.

· Press or to access the second level functions. · Press the Chem Frm key to convert the result in g/L of Chromate (CrO42¯) and Dichromate (Cr2O72¯). · Press or to return to the measurement screen. INTERFERENCES Interference may be caused by: Vanadium above 1 ppm. However, waiting 10 minutes before reading, the interference is removed Iron above 1 ppm Mercurous and mercuric ions cause slight inhibition of the reaction. 43 Chromium VI HR CHROMIUM VI LOW RANGE SPECIFICATIONS Range Resolution Accuracy Typical EMC Deviation Light Source Method 0 to 300 g/L 1 g/L ±1 g/L ±4% of reading at 25 °C ±1 g/L Tungsten lamp with narrow band interference filter @ 525 nm Adaptation of the ASTM Manual of Water and Environmental Technology, D1687-92, Diphenylcarbohydrazide method. The reaction between chromium VI and the reagent causes a purple tint in the sample. Description Powder reagent Quantity 1 packet REQUIRED REAGENTS Code HI 93749-0 REAGENT SETS HI 93749-01 Reagents for 100 tests HI 93749-03 Reagents for 300 tests For other accessories see page 132. MEASUREMENT PROCEDURE · Select the Chromium VI LR method using the procedure described in the Method Selection section (see page 12). · Fill the cuvette with 10 mL of unreacted sample (up to the mark) and replace the cap.

· Place the cuvette into the holder and close the lid. 10 mL · Press the Zero key. The meter will show "-0.0-" when the meter is zeroed and ready for measurement. · Remove the cuvette and add the content of one packet of HI 93749-0 reagent. Replace the cap and shake vigorously for about 10 seconds. Chromium VI LR 44 · Reinsert the cuvette into the instrument. · Press Timer and the display will show the countdown prior to the measurement or, alternatively, wait for 6 minutes and press Read. When the timer ends the meter will perform the reading. The instrument displays concentration in g/L of chromium VI.

· Press or to access the second level functions. · Press the Chem Frm key to convert the result in g/L of Chromate (CrO42¯) and Dichromate (Cr2O72¯). · Press or to return to the measurement screen. INTERFERENCES Interference may be caused by: Vanadium above 1 ppm. However, waiting 10 minutes before reading, the interference is removed.

Iron above 1 ppm Mercurous and mercuric ions cause slight inhibition of the reaction. 45 Chromium VI LR COLOR OF WATER SPECIFICATIONS Range Resolution Accuracy Typical EMC Deviation Light Source Method 0 to 500 PCU (Platinum Cobalt Units) 1 PCU ±10 PCU ±5% of reading at 25 °C ± 1 PCU Tungsten lamp with narrow band interference filter @ 420 nm Adaptation of the Standard Methods for the Examination of Water and Wastewater, 18th edition, Colorimetric Platinum Cobalt method. REQUIRED ACCESSORIES 0.45 m membrane for true color measurement. For other accessories see page 132.

MEASUREMENT PROCEDURE · Select the Color of Water method using the procedure described in the Method Selection section (see page 12). · Fill one cuvette up to the mark with deionized water and replace the cap. This is the blank. · Place the blank (# 1) into the holder and close the lid. #1 10 mL #1 · Press the Zero key. The meter will show "-0.0-" when the meter is zeroed and ready for measurement. · Remove the blank. Color of Water 46 · Fill the second cuvette up to the mark with unfiltered sample and replace the cap. This is the apparent color.

· Filter 10 mL of sample through a filter with a 0.45 m membrane into the third cuvette, up to the 10 mL mark and replace the cap. This is the true color. 10 mL #2 #3 · Insert the apparent color cuvette (# 2) into the instrument and close the lid. · Press Read to start the reading. · The meter displays the value of apparent color in PCU. #2 · Remove the cuvette, insert the true color cuvette (# 3) into the instrument and ensure that the notch on the cap is positioned securely into the groove. #3 · Press Read to start the reading. The meter displays the value of true color in PCU. 47 Color of Water COPPER HIGH RANGE SPECIFICATIONS Range Resolution Accuracy Typical EMC Deviation Light Source Method 0.

00 to 5.00 mg/L 0.01 mg/L ±0.02 mg/L ±4% of reading at 25 °C ±0.01 mg/L Tungsten lamp with narrow band interference filter @ 575 nm Adaptation of the EPA method.

The reaction between copper and the bicinchoninate reagent causes a purple tint in the sample. Description Bicinchoninate Quantity 1 packet REQUIRED REAGENTS Code HI 93702-0 REAGENT SETS HI 93702-01 Reagents for 100 tests HI 93702-03 Reagents for 300 tests For other accessories see page 132. MEASUREMENT PROCEDURE · Select the Copper HR method using the procedure described in the Method Selection section (see page 12). · Fill the cuvette with 10 mL of unreacted sample (up to the mark) and replace the cap. 10 mL · Place the cuvette into the holder and close the lid.

· Press the Zero key. The meter will show "-0.0-" when the meter is zeroed and ready for measurement. Copper HR 48 · Remove the cuvette. · Add the content of one packet of HI 93702-0 Bicinchoninate. Replace the cap and shake gently for about 15 seconds. · Reinsert the cuvette into the instrument. · Press Timer and the display will show the countdown prior to the measurement or, alternatively, wait for 45 seconds and press Read. When the timer ends the meter will perform the reading. · The instrument displays the results in mg/L of copper.

INTERFERENCES Interference may be caused by: Silver Cyanide For samples overcoming buffering capacity of reagent (around pH 6.8), pH should be adjusted between 6 and 8. 49 Copper HR COPPER LOW RANGE SPECIFICATIONS Range Resolution Accuracy Typical EMC Deviation Light Source Method 0 to 1000 g/L 1 g/L ±10 g/L ±5% of reading at 25 °C ±1 g/L Tungsten lamp with narrow band interference filter @ 575 nm Adaptation of the EPA method. The reaction between copper and the bicinchoninate reagent causes a purple tint in the sample. Description Bicinchoninate Quantity 1 packet REQUIRED REAGENTS Code HI 93747-0 REAGENT SETS HI 93747-01 Reagents for 100 tests HI 93747-03 Reagents for 300 tests For other accessories see page 132. MEASUREMENT PROCEDURE · Select the Copper LR method using the procedure described in the Method Selection section (see page 12).

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· Fill the cuvette with 10 mL of unreacted sample (up to the mark) and replace the cap. 10 mL · Place the cuvette into the holder and close the lid. · Press the Zero key. The meter will show "-0.
0-" when the meter is zeroed and ready for measurement. Copper LR 50 · Remove the cuvette. · Add the content of one packet of HI 93747-0 Bicinchoninate. Replace the cap and shake gently for about 15 seconds. · Reinsert the cuvette into the instrument.
· Press Timer and the display will show the countdown prior to the measurement or, alternatively, wait for 45 seconds and press Read. When the timer ends the meter will perform the reading. · The instrument displays the results in g/L of copper. INTERFERENCES Interference may be caused by: Silver Cyanide For samples overcoming buffering capacity of reagent (around pH 6.8), pH should be adjusted between 6 and 8.
51 Copper LR CYANURIC ACID SPECIFICATIONS Range Resolution Accuracy Typical EMC Deviation Light Source Method 0 to 80 mg/L 1 mg/L ±1 mg/L ±15% of reading at 25 °C ±1 mg/L Tungsten lamp with narrow band interference filter @ 525 nm Adaptation of the turbidimetric method. The reaction between cyanuric acid and the reagent causes a white suspension in the sample. Description Powder reagent Quantity 1 packet REQUIRED REAGENTS Code HI 93722-0 REAGENT SETS HI 93722-01 Reagents for 100 tests HI 93722-03 Reagents for 300 tests For other accessories see page 132. MEASUREMENT PROCEDURE · Select the Cyanuric Acid method using the procedure described in the Method Selection section (see page 12). · Fill the cuvette with 10 mL of unreacted sample (up to the mark) and replace the cap. 10 mL · Place the cuvette into the holder and close the lid. · Press the Zero key. The meter will show "-0.0-" when the meter is zeroed and ready for measurement. Cyanuric Acid 52 · Add the content of one packet of HI 93722-0 Cyanuric Acid Reagent.

Replace the cap and shake gently for about 10 seconds (dissolution is not complete). · Reinsert the cuvette into the instrument. · Press Timer and the display will show the countdown prior to the measurement or, alternatively, wait for 45 seconds and press Read. When the timer ends the meter will perform the reading. · The instrument displays concentration in mg/L of cyanuric acid. 53 Cyanuric Acid FLUORIDE SPECIFICATIONS Range Resolution Accuracy Typical EMC Deviation Light Source Method 0.00 to 2.00 mg/L 0.01 mg/L ±0.03 mg/L ±3% of reading at 25 °C ±0.
01 mg/L Tungsten lamp with narrow band interference filter @ 575 nm Adaptation of the Standard Methods for the Examination of Water and Wastewater, 18th edition, SPADNS method. The reaction between fluoride and the liquid reagent causes a red tint in the sample. Description SPADNS Reagent Quantity 4 mL REQUIRED REAGENT Code HI 93729-0 REAGENT SETS HI 93729-01 Reagents for 100 tests HI 93729-03 Reagents for 300 tests For other accessories see page 132. MEASUREMENT PROCEDURE · Select the Fluoride method using the procedure described in the Method Selection section (see page 12). · Add 2 mL of HI 93729-0 SPADNS Reagent to two cuvettes.
· Fill one of the cuvettes with distilled water up to the mark, replace the cap and invert several times to mix. · Fill the other cuvette with sample up to the mark, replace the cap and invert several times to mix. #1 10 mL #1 2 mL 10 mL #2 · Place the cuvette with the reacted distilled water (# 1) into the holder and close the lid. Fluoride 54 · Press Timer and the display will show the countdown prior to zeroing the blank or, alternatively, wait for two minutes and press Zero. The display will show "-0.
0-" when the meter is zeroed and ready for measurement. · Remove the cuvette. · Insert the other cuvette (# 2) with the reacted sample into the instrument. #2 · Press Read to start reading. The instrument displays the results in mg/L of fluoride. Note: For wastewater or seawater samples, before performing measurements, distillation is required. For most accurate results, use two graduated pipettes to deliver exactly 8 mL of distilled water and 8 mL of sample. INTERFERENCES Interferences may be caused by: Alkalinity (as CaCO3) above 5000 mg/L Aluminum above 0.1 mg/L Iron, ferric above 10 mg/L Chloride above 700 mg/L Phosphate, ortho above 16 mg/L Sodium hexametaphosphate above 1.0 mg/L Sulfate above 200 mg/L Highly colored and turbid samples may require distillation Highly alkaline samples can be neutralized with nitric acid.

55 Fluoride CALCIUM HARDNESS SPECIFICATIONS Range Resolution Accuracy Typical EMC Deviation Light Source Method 0.00 to 2.70 mg/L 0.01 mg/L ±0.11 mg/L ±5% of reading at 25 °C ±0.01 mg/L Tungsten lamp with narrow band interference filter @ 525 nm Adaptation of the Standard Methods for the Examination of Water and Wastewater, 18th edition, Calmagite method. The reaction between calcium and reagents causes a reddish-violet tint in the sample. Description Ca & Mg indicator Alkali solution EGTA solution Quantity 0.5 mL 0.5 mL 1 drop REQUIRED REAGENTS Code HI 93720A-0 HI 93720B-0 HI 93720C-0 REAGENT SETS HI 93720-01 Reagents for 100 tests HI 93720-03 Reagents for 300 tests For other accessories see page 132. MEASUREMENT PROCEDURE · Select the Calcium Hardness method using the procedure described in the Method Selection section (see page 12). · Rinse a graduated beaker several times with unreacted sample, before filling it to the 50 mL mark with the sample. · Add 0.5 mL of HI 93720A-0 Calcium indicator solution and swirl to mix. · Add 0.
5 mL of HI 93720B-0 Alkali solution and swirl to mix. Use this solution to rinse 2 cuvettes before filling them up to the 10 mL mark. #1 #2 Hardness Ca 56 · Add 1 drop of HI 93720C-0 EGTA solution to one cuvette (# 1), replace the cap and invert the cuvette several times to mix. This is the blank. #1 #1 · Place the blank (# 1) into the holder and close the lid.
· Press the Zero key. The meter will show "-0.0-" when the meter is zeroed and ready for measurement. · Remove the blank and insert the second cuvette (# 2) into the instrument. #2 · Press Read to start the reading. The instrument displays concentration in mg/L of calcium hardness, as CaCO3. · Press or to access the second level functions. · Press the Chem Frm key to convert the result in mg/L of Calcium (Ca2+). 57 Hardness Ca · Press the Unit key to change the current measurement unit. @@Note: This test will detect any calcium contamination in the beaker, measuring syringes or sample cells.

To test cleanliness, repeat the test multiple times until you obtain consistent results.

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Note: For better accuracy wash glassware with HCl 6N. SAMPLE DILUTION This meter is designed to determine low levels of hardness, typically found in water purification systems. When testing some other sources of water, it is not uncommon to come across levels of hardness that are greater than the range of this meter. This problem can be overcome through dilution. @@@@@@@@@@@@@@@@@@@@@@@ · Press Read to start the reading. @@@@@@@@@@@@@@@@@@@@@@@The display will show "-0.0-" when the meter is zeroed and ready for measurement. · Remove the blank. · Insert the cuvette with the reacted sample (# 2) into the instrument and close the lid.

#2 · Press Read to start the reading. The instrument displays concentration in g/L of hydrazine. INTERFERENCES Interference may be caused by: Highly colored samples Highly turbid samples Aromatic amines 63 Hydrazine IODINE SPECIFICATIONS Range Resolution Accuracy Typical EMC Deviation Light Source Method 0.0 to 12.5 mg/L 0.

1 mg/L ±0.1 mg/L ±5% of reading at 25 °C ±0.1 mg/L Tungsten lamp with narrow band interference filter @ 525 nm Adaptation of the Standard Methods for the Examination of Water and Wastewater, 18th edition, DPD method. The reaction between iodine and the reagent causes a pink tint in the sample. Description DPD Reagent Quantity 1 packet REQUIRED REAGENTS Code HI 93718-0 REAGENT SETS HI 93718-01 Reagents for 100 tests HI 93718-03 Reagents for 300 tests For other accessories see page 132.

MEASUREMENT PROCEDURE · Select the Iodine method using the procedure described in the Method Selection section (see page 12). · Fill the cuvette with 10 mL of unreacted sample (up to the mark) and replace the cap. · Place the cuvette into the holder and close the lid. · Press the Zero key. The display will show "-0.0-" when the meter is zeroed and ready for measurement. 10 mL · Remove the cap and add the content of one packet of HI 93718-0 DPD reagent. Replace the cap and shake gently for about 30 seconds to dissolve most of the reagent. Iodine 64 · Reinsert the cuvette into the instrument. · Press Timer and the display will show the countdown prior to the measurement or, alternatively, wait for 2 minutes and 30 seconds and press Read.

When the timer ends the meter will perform the reading. · The instrument displays concentration in mg/L of iodine. INTERFERENCES Interference may be caused by: Bromine, Chlorine, Ozone, Oxidized forms of Chromium and Manganese. In case of water with hardness greater than 500 mg/L CaCO3, shake the sample for approximately 2 minutes after adding the reagent. In case of water with alkalinity greater than 250 mg/L CaCO3 or acidity greater than 150 mg/L CaCO3, the color of the sample may develop only partially, or may rapidly fade. To resolve this, neutralize the sample with diluted HCl or NaOH. 65 Iodine IRON HIGH RANGE SPECIFICATIONS Range Resolution Accuracy Typical EMC Deviation Light Source Method 0.00 to 5.00 mg/L 0.01 mg/L ±0.

04 mg/L ±2% of reading at 25 °C ±0.01 mg/L Tungsten lamp with narrow band interference filter @ 525 nm Adaptation of the EPA Phenantroline method 315B, for natural and treated waters. The reaction between iron and reagents causes an orange tint in the sample. Description Powder Reagent Quantity 1 packet Code HI 93721-0 REQUIRED REAGENTS REAGENT SETS HI 93721-01 Reagents for 100 tests HI 93721-03 Reagents for 300 tests For other accessories see page 132. MEASUREMENT PROCEDURE · Select the Iron HR method using the procedure described in the Method Selection section (see page 12).

· Fill the cuvette with 10 mL of unreacted sample (up to the mark) and replace the cap. · Place the cuvette into the holder and close the lid. 10 mL · Press the Zero key. The display will show "-0.0-" the meter is zeroed and ready for measurement.

· Remove the cuvette and add the content of one packet of HI 93721-0 reagent. Replace the cap and shake until dissolution is complete. Iron HR 66 · Reinsert the cuvette into the instrument. · Press Timer and the display will show the countdown prior to the measurement or, alternatively, wait for 3 minutes and press Read. When the timer ends the meter will perform the reading. · The instrument displays concentration in mg/L of iron. INTERFERENCES Interference may be caused by: Molybdate Molybdenum above 50 ppm Calcium above 10000 ppm (as CaCO3) Magnesium above 100000 ppm (as CaCO3) Chloride above 185000 ppm. 67 Iron HR IRON LOW RANGE SPECIFICATIONS Range Resolution Accuracy Typical EMC Deviation Light Source Method 0 to 400 g/L 1 g/L ±10 g/L ±8% of reading at 25 °C ±1 g/L Tungsten lamp with narrow band interference filter @ 575 nm Adaptation of the TPTZ Method. The reaction between iron and the reagent causes a violet tint in the sample. Description TPTZ Reagent Quantity 2 packets REQUIRED REAGENTS Code HI 93746-0 REAGENT SETS HI 93746-01 Reagents for 50 tests HI 93746-03 Reagents for 150 tests For other accessories see page 132.

MEASUREMENT PROCEDURE · Select the Iron LR method using the procedure described in the Method Selection section (see page 12). · Fill one graduated mixing cylinder up to the 25 mL mark with deionized water. 25 mL · Add the content of one packet of HI 93746-0 TPTZ reagent, close the cylinder and shake vigorously for 30 seconds. This is the blank. · Fill a cuvette with 10 mL of the blank up to the mark and replace the cap. · Place the cuvette into the holder and close the lid. 10 mL Iron LR 68 · Press the Zero key. The display will show "-0.0-" when the meter is zeroed and ready for measurement. · Remove the cuvette.

· Fill another graduated mixing cylinder up to the 25 mL mark with the sample. 25 mL · Add the content of one packet of HI 93746-0 TPTZ reagent, close the cylinder and shake vigorously for 30 seconds. This is the reacted sample. · Fill a cuvette with 10 mL of the reacted sample up to the mark and replace the cap. 10 mL · Insert the sample into the instrument.

· Press Timer and the display will show the countdown prior to the measurement or, alternatively, wait for 30 seconds and press Read. When the timer ends the meter will perform the reading. The instrument displays concentration in g/L of iron. 69 Iron LR INTERFERENCES Interference may be caused by: Cadmium above 4.0 mg/L Chromium3+ above 0.

25 mg/L Chromium6+ above 1.2 mg/L Cobalt above 0.05 mg/L Copper above 0.6 mg/L Cyanide above 2.8 mg/L Manganese above 50.0 mg/L Mercury above 0.4 mg/L Molybdenum above 4.0 mg/L Nickel above 1.0 mg/L Nitrite ion above 0.8 mg/L Sample pH should be between 3 and 4 to avoid developed color to fade or turbidity formation.

Iron LR 70 MAGNESIUM SPECIFICATIONS Range Resolution Accuracy Light Source Method 0 to 150 mg/L 5 mg/L ±5 mg/L ±3% of reading at 25 °C Tungsten lamp with narrow band interference filter @ 466 nm Adaptation of the Calmagite method.

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