

# Spectrophotometers and Portable Labs

On the bench and in the field,  
Hach meets your water analysis needs



▶ DR/2500



▶ DR/2400

Analysts love the tremendous capability and the small footprint of the DR/2500 Spectrophotometer.  
Pictured above: (left to right) Jason Skelton, Sharon Petsche, and Toby Stuart of Colorado Fisheries.



▶ DREL Portable Labs

# DR/2500

► The new **Hach DR/2500 Scanning Spectrophotometer** is an innovative water analysis instrument, designed to help industries and municipalities meet regulatory requirements for drinking water, wastewater, and boiler and cooling water.

## **SUPERIOR TECHNOLOGY**

- Automatic wavelength calibration ensures superior accuracy.
- Automatic wavelength selection saves time and eliminates the possibility of user error.
- Built-in pH meter with one-touch operation does not interfere with photometric testing.
- Universal cell adapter accommodates different sample cells and provides quick and easy test setup.
- Patented, advanced concentric polychromatic optical system gives you tremendous accuracy and precision.

## **EASY TO USE**

- Comes with illustrated reference manual.
- First to offer an innovative touch screen interface.
- Interactive software guides you through easy, often automated steps.
- Favorite Program Menu lets you save frequently-used program for quick access.
- Sliding hood and touch screen design make it easy to clean and spill resistant.
- Built-in shortcuts allow instant access to adjustable setting options such as date, resolution, measurement units, user ID, and sample ID.



## TECHNICALLY SUPERIOR

### BUILT-IN PH METER

The DR/2500 is equipped with a 5-pin connector to accept an optional pH electrode such as Hach's popular sension™ Platinum Series pH Combination Electrode, which is proven to provide fast response even in cold, near-neutral samples. With a built-in pH meter, you can make convenient pH measurements without switching to a second instrument. Analysts in laboratories of all sizes appreciate convenience like this!

### MORE THAN 130 PREPROGRAMMED TESTS

The DR/2500 detects more than 65 substances using pre-programmed tests that automatically set the wavelength and prompt you through the procedure. Create a "Favorite Programs" menu for quick selection or add up to 50 user-generated calibrations.

### AUTOMATIC WAVELENGTH SELECTION AND CALIBRATION

The automatic wavelength selection feature eliminates manual adjustments and reduces human error. Instrument software automatically selects the correct measurement wavelength, no dials to adjust! Automatic wavelength calibration is performed at power-up. With a wavelength accuracy of  $\pm 1$  nm, the DR/2500 gives you brilliant performance – the kind no water quality lab should be without.

### STREAMLINED CELL MANAGEMENT

A single, versatile cell adapter lets you read samples fast and accurately. The patent pending cell holder centers all round sample vials from 0.35-inch (9 mm) diameter to 1.00-inch (25 mm) diameter, automatically, eliminating the need for an array of individual cell adapters. A similar adapter holds cuvettes from 1x1 cm to 1x5 cm.

### COMPREHENSIVE DATA MANAGEMENT

Store and recall 1000 data points with operator-selected information such as time, date, sample ID, and operator ID. You can see stored or recall-time data in tabular or graphic form on the instrument screen, or send it to a computer or printer via the parallel or serial port.

### UPDATE CAPABILITY AND CUSTOMIZED PROGRAMS

More than 130 Hach methods are permanently stored in the instrument's non-volatile memory. And, it's easy to update the DR/2500 on site using an RS-232/PC link, or the DR/2500's compact upload device that plugs into its 5-pin connector. Store up to 50 of your own calibrations – linear, cubic, or quadratic; single or multiple-wavelength – without tedious keying sequences. (Multiple-wavelength custom calibrations require the optional Advanced Software Package). Your DR/2500 is a living analysis system!

### OPTIONAL ADVANCED SOFTWARE PACKAGE

**Multiple-wavelength** analysis lets you make a measurement in concentration, absorbance, or %T at up to 4 different wavelengths. Software displays all readings and calculates the aggregate multiple-wavelength reading based on the operator-selected formula. With the **wavelength scan** feature, the operator selects the wavelength range of interest and measures spectra in Absorbance or %T. A flexible cursor mode of navigation lets you easily view all scan details: track the entire spectra, use the zoom feature to examine data detail, and apply the peak-and-valley-find feature to quickly locate peaks and valleys in the scan. **Time-course analysis**, measures absorbance or %T at a single wavelength over a user-selected period of time so you can determine how quickly color develops, how stable it is, and how soon it decays. Again, you use cursor navigation and zoom viewing to review data.

## EASY TO USE

### BUILT-IN SHORTCUTS WITH TOUCH SCREEN DISPLAY

You can access instrument settings such as time, date, resolution, units of measure, user ID, and sample ID, just by touching that setting readout on the screen. The built-in shortcut gives you instant access to that setting's adjustment options.

### FAVORITE PROGRAMS MENU

The Favorite Programs Menu allows you to save frequently used programs to your own short list of favorites for quick access.

### UPDATE CAPABILITY

Although the DR/2500 has 130 pre-programmed tests, Hach is always busy creating new procedures. Keep your instrument updated with RS-232/PC link or a convenient upload device that plugs into the 5-pin connector. Either way, it's sure to increase your productivity.

### DATA STORAGE/MEMORY CAPABILITIES

Store and recall up to 1000 data points with operator-selected identification information such as date, time, 10-character sample ID, and 3-character operator ID attached. All data can be viewed in tabular or graphic form and output via serial or parallel output to your computer or printer. (An internal backup battery provides a brief period of temporary power to assure completion of the test underway if the normal power supply is interrupted.)

# DR/2500

► **Enthusied customers praise Hach's DR/2500 Spectrophotometer for use in wide variety of applications.**

Hach recently interviewed four customers to discover what they thought about the new DR/2500 Spectrophotometer, a state-of-the-art water quality analysis tool designed for the water, wastewater, and industrial water treatment industries.

Hach thought it would be helpful to their customers, who work in a wide variety of applications, to hear what other users had to say. The DR/2500 has many sophisticated new features and functions. It was designed to be technically superior and easy to use. But what do the actual users think about the DR/2500? Not surprisingly, these folks have lots to say. Now, from power plants to fisheries, here's the good news!

## **COLORADO "TROPHY" TROUT FARM AQUACULTURE APPLICATION**

"We love the DR/2500," says Shannon Skelton, president of Colorado Fisheries, Inc. in Ft. Collins, Colorado, and his wife, Sharon Petsche, vice president. Shannon explains, "If you give trout optimal water quality, you obtain optimal results. The thing I love most about Hach's machine is its consistent accuracy."

Colorado Fisheries is acclaimed by the Natural Aquaculture Association for its raising practices, earthen pond, and natural aquatic feeds. Sharon notes that it is actually harder to keep the water right when raising trout in earthen, not concrete, ponds. "We raise ten species of trout and need to do many tests with the DR/2500. We need to control phosphate levels so we don't have algae blooms. We test to make sure dissolved oxygen levels are ok for the fish. We test for ammonia levels, and monitor wastewater levels of excrement and sludge. Another critical test is for nitrates from farm run-off." When asked about the pH capabilities of Sharon's new she replied, "I love it. It's easy and simple, just plug it in, hit the button and wham, you've got your answer! I always believe my results are very accurate as well."

One of the top reasons they chose the Hach DR/2500 was "we were very impressed with the high level of Hach's customer service." Sharon's favorite feature? "I like the fact we can store all our information in the "favorites" section on the computer menu. It's nice not to have to scroll, memorize test numbers or look it up every time."

## **1950'S DRINKING WATER FILTRATION PLANT APPLICATION IN TENNESSEE**

Doug Summers is Plant Manager of the 42-year-old Cumberland Water Filtration Plant in Hermitage, Tennessee, a suburb south of Nashville. The plant, which opened in 1959, was last upgraded in the late 1990s. Today it serves 13,000 customers in the middle of the state. It has an average capacity of 5.5 to 6 million gallons/day, with an emergency capacity of 9 million gallons/day.

In the water business since 1974, Summers recalls, "In the old days – the sixties – you had to make up a test solution. There was a lot of lab preparation. It was a long, drawn-out thing and it left the operator with more of a chance to make a mistake."

Summers is a real fan of Hach's new DR/2500 touch-screen spectrophotometer. "There's less chance of error. It's a whole lot easier. It records test data that you can date and save with the memory function. And it goes to a higher percentage when testing chlorine residuals."

A lab technician and three operators test for chlorine, manganese, iron and fluoride. "The DR/2500 was easy to learn," Doug declares. "It's simple. There's the Hach manual with pictures that are easy to refer to. You can follow it step-by-step. The machine does most of the work. And the pre-measured reagent ampules really eliminate a lot more error." What's another of Doug's favorite features? "I like the touch-control screen. It's quick and easy."

### **NEW DRINKING WATER FILTRATION PLANT APPLICATION IN WISCONSIN**

The City of Oshkosh water filtration plant is a brand new, state-of-the-art facility that has been up and running for about a year and a half. The operators are enthused about using the state-of-the-art DR/2500 Spectrophotometer. Lab technician Russell Johnson shares their view. "Speed and accuracy are our #1 priorities here. With the DR/2500 you get an instant read, write it down, and go on to the next step right away. It's easy to set up for the lab."

Johnson, with 24 years of experience under his belt, says they all like the DR/2500's touch-control screen, because "you just touch it and it's right there. Not like when you tested with the old color wheel that we used up until about ten years ago." You could do ten different tests and get ten different results with that!"

He adds, "The DR/2500 cell holders fit without having to line everything up, too. It's great when only one guy is on a night, weekend, or holiday shift." Johnson and crew run tests for total chlorine and free chlorine, phosphates, ozone, and are going to start to run a fluoride test soon. The City of Oshkosh's water plant capacity serves 60,000 people with a capacity of 16 million gallons/day.

### **TEXAS POWER PLANT APPLICATIONS: COOLING TOWER, MAKE-UP WATER AND WASTE WATER**

"It's a good machine. I'm happy with it." Mac McCollum has three DR/2500s to monitor cooling tower water, make-up water and waste water – 10 million gallons per day. Mac's been "doing power" since the late 1980s. Now he oversees two Calpine power plants about a mile apart in Edinburg, Texas, near the Rio Grand Valley. Calpine serves up to 1.5 million homes in Texas and is projected to be the biggest power plant in North America by 2005.

With no lab techs, the operators "have to do it all," says Mac. "At first it was a little hard to adapt to the DR/2500, but now they're doing well with it." They easily run tests on the DR/2500 including those for silicas, phosphates, chlorine, sulfates, ammonia, hardness, and calcium-magnesium.

Test results are "near instant" according to Mac, taking into account the reaction time of different tests. "The DR/2500 is user-friendly and reasonably priced." One of his favorite features? The upgrade chips. Because Hach continually develops new methods for simplified water quality testing, it's easy to upgrade the on site with the chips.

# DR/2400

► With Hach's new DR/2400 Portable Spectrophotometer, you get:

- The portable solution you need to optimize your water analysis program, anywhere, anytime.
- The superior technology you expect in a spectrophotometer.
- The ease of use you require to support all personnel.
- The attractive price and value you want.

The DR/2400 Portable Spectrophotometer brings you the technically superior operation and innovative user interface of the popular DR/2500 Spectrophotometer, plus a design that makes it completely portable. Now you can have it all in your photometric water analysis program, whether it's municipal, industrial, environmental, or educational; in the lab, at the process site, or in the field.



## TECHNICALLY SUPERIOR

### **MORE THAN 130 PREPROGRAMMED TESTS**

The DR/2400 detects more than 65 substances using pre-programmed tests that automatically set the wavelength and prompt you through the procedure. Create a "Favorite Programs" menu for quick selection or add up to 50 user-generated calibrations.

### **AUTOMATIC WAVELENGTH SELECTION AND CALIBRATION**

This feature eliminates manual dialing, thereby reducing possible adjustment errors. Just press a few buttons and the instrument automatically sets the correct wavelength when you select the test you need. The instrument performs an automatic wavelength calibration when it is turned on. A wavelength accuracy of  $\pm 1$  nm gives you precise performance - the kind you need in your laboratory!

### **COMPREHENSIVE DATA MANAGEMENT**

Store and recall 1000 data points with operator-selected information such as time, date, sample ID, and operator ID. You can see stored or recall-time data in tabular or graphic form on the instrument screen, or send it to a computer or printer via the parallel or serial port.

### **UPDATE CAPABILITY AND CUSTOMIZED PROGRAMS**

More than 130 Hach methods are permanently stored in the instrument's non-volatile memory. And, it's easy to update the DR/2400 on site using an RS-232/PC link, or the DR/2400's compact upload device that plugs into its 5-pin connector. Store up to 50 of your own calibrations - linear, cubic, or quadratic; single or multiple-wavelength - without tedious keying sequences. (Multiple-wavelength custom calibrations require the optional Advanced Software Package). Your DR/2400 is a living analysis system!

### **HIGH PERFORMANCE OPTICAL SYSTEM**

The advanced optics is based on a concentric polychromator with top-notch as with the DR/2500 instrument. It has no moving parts to wear out or be replaced. The system significantly reduces stray light, which allows for extended range performance. A highly integrated array sensor detects the signal from solid state LEDs (in the visible range). The optics are tested and certified against ASTM Standard E-275-83.

### **PREPROGRAMMED ACCURACY CHECKS**

This program lets you run a standard additions check with assistance from the software and step-by-step instructions. This procedure helps you resolve problems such as sample interferences, bad reagents, instrument problems and faulty procedure. See the Accuracy Check section following each test for more information.

## EASY TO USE

### **FAVORITE PROGRAMS MENU**

If you run the same tests over and over, the Favorite Programs Menu lets you have quick access to these tests. Save yourself some scrolling time!

### **BATTERY-POWERED/COMPACT SIZE**

What else would you expect from a portable spectrophotometer? Now you can benefit from sophisticated spectrophotometer capability anywhere. Uses three D cell batteries (included) and can also operate with line power. An optional rechargeable battery pack is available. Its small size and handle lets you carry it with one hand, so you can navigate the terrain more easily.

### **UPDATE CAPABILITY**

Although the DR/2400 has 130 pre-programmed tests, Hach is always busy creating new procedures. Keep your instrument updated with RS-232/PC link or a convenient upload device that plugs into the 5-pin connector. Either way, it's sure to increase your productivity.

### **DATA STORAGE/MEMORY CAPABILITIES**

Store and recall up to 1000 data points with operator-selected identification information such as date, time, 10-character sample ID, and 3-character operator ID attached. All data can be viewed in tabular or graphic form and output via serial or parallel output to your computer or printer. (An internal backup battery provides a brief period of temporary power to assure completion of the test underway if the normal power supply is interrupted.)

### **ACCESSORIES AS YOU NEED THEM**

The instrument has a variety of optional accessories for your convenience. The selection allows you to buy only the options you need. Selections include HachLink™ Software to format data, several types of sample cells, and a Pour-Thru cell for accurate, high-volume testing.

# DR/2400

## ► Versatile DR/2400 Expands Laboratory Capabilities

James Beckley, Laboratory Manager for Sussex Service Authority in Virginia, couldn't be happier with the lab's new DR/2400 spectrophotometer. He uses the instrument primarily for COD testing, analyzing three batches a week for each of the five wastewater facilities run by the Sussex Service Authority (SSA). He also tests for iron and magnesium as a back up for the other plants.

Beckley says, "Overall, the DR/2400 is a really good unit, especially for the price." One of the key selling points for Beckley was the instrument's ability to use multiple types of vials. It can handle 25 mm round vials, AccuVac" vials, COD/Test 'N Tube Unicell' Vials, 1 cm square cuvettes, and 1 cm x 1-inch dual pathlength cuvettes. A Pour-Thru Cell is also available for rapid batch testing.

Although the DR/2400 is a robust portable spectrophotometer, the SSA uses it as their main laboratory spectrophotometer. Beckley appreciates its small size and that it can analyze for so many parameters, allowing for analytical expansion. In the future, Beckley will be analyzing for fluoride in the field to determine if a water main is leaking or if ground water is the source of the water. Plans also call for fluoride testing throughout the wastewater plants, a perfect application for this portable instrument. Also in the works is a new water laboratory and Beckley will be using the DR/2400 to measure chlorine, permanganate, iron, and possibly nitrate and phosphate at the new facility.

After several months of using the DR/2400, Beckley says he "loves it." The instrument is doing a great job for his laboratory and he has been very satisfied with its performance.

# Flow Cell

## ► Flow Cell Adds Accuracy

This optional accessory is available as Pour-Thru Cell Kit for the DR/2400 and DR/2500.

These accessories offer a fixed sample cell that permits samples to be poured through it. Because the optical conditions are the same for each blank, standard, and sample, any error that may be caused by optical differences between cells is eliminated. It also eliminates errors due to smudges and scratches that can be caused by handling sample cells.

Cleaning the cell is so easy – just pour the flushing fluid into the cell. This eliminates contamination from residual fluid from the last sample.

The Pour-Thru Cell operates using gravity to purge the sample from the cell to a drain. The flow rate and sample volume are controlled by adjusting the height of the Collection Drain Assembly.





# DREL/2400

## ► DREL/2400 Complete Water Quality Laboratory

Drinking water and municipal wastewater testing

### Everything you need to set up a water quality analysis program

The DREL/2400 Complete Water Quality Laboratory meets the needs of users seeking convenience and economy, as well as a wide range of analysis capabilities. The flexibility of this product makes it an ideal starting point for new laboratories, as it includes most tests that are likely to be required for general analysis.

The Complete Water Quality Laboratory contains everything needed for complete water analysis:

- DR/2400 Spectrophotometer
- Digital titrator
- Procedure manual
- Power supply
- Reagents and apparatus
- Two cases, one for instruments and one for apparatus and chemistry

The system tests 22 common water quality parameters, and can be upgraded with a sensION™ 156 for pH, dissolved oxygen, and conductivity testing, 2100P Portable Turbidimeter, as well as additional reagents. The cases supplied with the Lab include storage space for these optional instruments and supplies.

The DREL/2400 Complete Water Quality Laboratory tests the following parameters:

Parameter	Range
Acidity	10-4000 mg/L
Alkalinity*	10-4000 mg/L
Bromine	0.05-4.50 mg/L
Calcium*	10-4000 mg/L
Chloride*	10-10000 mg/L
Chlorine, Free & Total	0.02-2.00 mg/L
Chromium, Hex	0.01-0.70 mg/L
Color	1-500 Pt Co Units
Copper	0.04-5.00 mg/L
Hardness*	10-4000 mg/L
Iodine	0.07-7.00 mg/L
Iron, Total	0.02-3.00 mg/L
Molybdate	0.0-40.0 mg/L
Nitrogen, Ammonia	0.01-0.50 mg/L
Nitrogen, Nitrate	0.3-30.0 mg/L
Nitrogen, Nitrite	0.3-30.0 mg/L
Phosphorus, R&T	0.02-2.50 mg/L
Silica, HR	0.01-1.60 mg/L
Sulfate	2-70 mg/L
Sulfide	5-800 mg/L
Suspended Solids	0-750 mg/L

\*Titration method



## ► DREL/2400 Basic Water Quality Laboratory

Drinking water and municipal wastewater testing

### For those ready to start in water quality testing

The DREL/2400 Basic Water Quality Laboratory is a perfect starter kit for those just beginning water quality testing. This Laboratory allows determination of key indicator parameters important for those performing basic analysis.

The Basic Water Quality Laboratory contains everything necessary for basic water analysis:

- DR/2400 Spectrophotometer
- Digital titrator
- Procedure manual
- Power supply
- Reagents and apparatus
- Two cases, one for instruments and one for apparatus and chemistry

The system tests 16 basic water quality parameters, and can be upgraded with a *sension™* 156 for pH, dissolved oxygen, and conductivity measurement, the 2100P Portable Turbidimeter, as well as additional reagents as instruments. The cases supplied with the Lab include storage space for these optional instruments and supplies.

The DREL/2400 Basic Water Quality Laboratory tests the following parameters:

Parameter	Range
Alkalinity*	10-4000 mg/L
Bromine	0.05-4.50 mg/L
Calcium*	10-4000 mg/L
Chloride*	10-10000 mg/L
Chlorine, Free & Total	0.02-2.00 mg/L
Chromium, Hex	0.01-0.70 mg/L
Color	1-500 Pt Co Units
Copper	0.04-5.00 mg/L
Iodine	0.07-7.00 mg/L
Iron, Total	0.02-3.00 mg/L
Nitrogen, Ammonia	0.01-0.50 mg/L
Nitrogen, Nitrate	0.3-30.0 mg/L
Phosphorus	0.02-2.50 mg/L
Sulfate	2-70 mg/L
Suspended Solids	0-750 mg/L

\*Titration method



## ► DREL/2400 Industrial Water Quality Laboratory

Industrial wastewater testing

### Protect your boilers and cooling towers

The DREL/2400 Industrial Water Quality Laboratory is designed specifically for those performing analyses of industrial process water quality. The Laboratory provides all tests to ensure water quality and process integrity and to protect boilers and cooling towers from the damaging effects of contaminants.

The Industrial Water Quality Laboratory contains everything necessary for industrial water analysis:

- DR/2400 Spectrophotometer
- Digital titrator
- Procedure manual
- Power supply
- Reagents and apparatus
- Two cases, one for instruments and one for apparatus and chemistry

The system tests 23 industrial water quality parameters, and can be upgraded with a sensioN™ 156 for pH, dissolved oxygen, and conductivity measurement, the 2100P Portable Turbidimeter, as well as additional reagents as instruments. The cases supplied with the Lab include storage space for these optional instruments and supplies.

The DREL/2400 Complete Water Quality Laboratory tests the following parameters:

Parameter	Range
Alkalinity*	10-4000 mg/L
Bromine	0.05-4.50 mg/L
Calcium*	10-4000 mg/L
Chloride*	10-10000 mg/L
Chlorine, Free & Total	0.02-2.00 mg/L
Chromium, Hex	0.01-0.70 mg/L
Color	1-500 Pt Co Units
Copper	0.04-5.00 mg/L
Hardness*	10-4000 mg/L
Iodine	0.07-7.00 mg/L
Iron, Total	0.02-3.00 mg/L
Manganese	0.2-20.0 mg/L
Molybdate	0.0-40.0 mg/L
Nitrogen, Ammonia	0.01-0.50 mg/L
Nitrogen, Nitrate	0.3-30.0 mg/L
Nitrite	2-250 mg/L
Oxygen Scavengers	0-450 ug/L
Phosphorus, Total	0.02-2.50 mg/L
Silica	0.01-1.60 mg/L
Sulfate	4-400 mg/L
Suspended Solids	0-750 mg/L

\*Titration method



## Parameters, Methods, Reagent Sets and Ranges

The table below lists test ranges, method of analysis, and corresponding reagent sets. The complete procedure for each test is included in the manual supplied with the instrument and also can be viewed and downloaded at [www.hach.com](http://www.hach.com). The ranges given are for the precalibrated instrument readout; higher ranges can be measured by sample dilution.

Test	Method	Range	Cat. No.
Aluminum	Aluminon	0.008-0.800 mg/L	22420-00
Aluminum	Eriochrome Cyanine R	0.002-0.250 mg/L	26037-00
Arsenic (USEPA)*	Silver Diethyldithiocarbamate	0-0.200 mg/L	-
Barium	Turbidimetric	0-100 mg/L	12064-99
Barium (AccuVac®)	Turbidimetric	0-100 mg/L	25130-25
Benzotriazole	UV Photolysis	1-16.0 mg/L	21412-99
Boron	Carmin	0.2-14.0 mg/L	-
Boron, LR	Azomethine-H	0.02-1.50 mg/L	26669-00
Bromine	DPD	0.05-4.50 mg/L	21056-69
Bromine (AccuVac®)	DPD	0.05-4.50 mg/L	25030-25
Chloramine, Mono, LR	Indophenol	0.04-4.50 mg/L	28022-46
Chloramine, Mono, HR	Indophenol	0.1-10.0 mg/L	28051-45
Chloride	Mercuric Thiocyanate	0.1-25.0 mg/L	23198-00
Chlorine Dioxide (USEPA)	DPD	0.04-5.00 mg/L	27709-00
Chlorine Dioxide (AccuVac®) (USEPA)	DPD	0.04-5.00 mg/L	27710-00
Chlorine Dioxide, LR	Chlorophenol Red	0.01-1.00 mg/L	22423-00
Chlorine Dioxide, HR	Direct Reading	5-1000 mg/L	-
Chlorine, Free (USEPA)	DPD	0.02-2.00 mg/L	21055-69
Chlorine, Free (AccuVac®) (USEPA)	DPD	0.02-2.00 mg/L	25020-25
Chlorine, Free TNT	DPD	0.09-5.00 mg/L	21055-45
Chlorine, Free RL	DPD	0.02-2.00 mg/L	25569-00
Chlorine, Total (USEPA)	DPD	0.02-2.00 mg/L	21056-69
Chlorine, Total (AccuVac®) (USEPA)	DPD	0.02-2.00 mg/L	25030-25
Chlorine, Total, ULR (USEPA)	DPD	2-500 µg/L	25630-00
Chlorine, Total RL	DPD	0.02-2.00 mg/L	25570-00
Chlorine, Total TNT	DPD	0.09-5.00 mg/L	21056-45
Chromium, Hexavalent (USEPA)	1,5-Diphenylcarbohydrazide	0.01-0.70 mg/L	12710-99
Chromium, Hexavalent (AccuVac®) (USEPA)	1,5-Diphenylcarbohydrazide	0.01-0.70 mg/L	25050-25
Chromium, Total	Alkaline Hypobromite	0.01-0.70 mg/L	22425-00
Cobalt	PAN	0.01-2.00 mg/L	26516-00
Color, True and Apparent	APHA Pt-Co	5-500 units	-
Copper (USEPA)*	Bicinchoninate	0.04-5.000 mg/L	21058-69
Copper (AccuVac®) (USEPA)	Bicinchoninate	0.04-5.000 mg/L	25040-25
Copper	Porphyrin	2-210 µg/L	26033-00
Cyanide	Pyridine-Pyrazalone	0.001-0.240 mg/L	24302-00
Cyanuric Acid	Turbidimetric	5-50 mg/L	2460-66
Fluoride (AccuVac®) (USEPA)**	SPADNS	0.02-2.00 mg/L	25060-25
Fluoride (Reagent Solution) (USEPA)**	SPADNS	0.02-2.00 mg/L	444-49
Formaldehyde	MBTH	3-500 µg/L	22577-00
Hardness, Total, ULR	Chlorophosphonazo	0-1000 µg/L	26031-00
Hardness, Calcium or Magnesium as CaCO <sub>3</sub>	Calmagite, Colorimetric	0.07-4.00 mg/L	23199-00
Hydrazine	p-Dimethylaminobenzaldehyde	4-600 µg/L	1790-32
Hydrazine (AccuVac®)	p-Dimethylaminobenzaldehyde	4-600 µg/L	25240-25
Iodine	DPD	0.07-7.00 mg/L	21056-69
Iodine (AccuVac®)	DPD	0.07-7.00 mg/L	25030-25
Iron, Ferrous	1,10-Phenanthroline	0.02-3.00 mg/L	1037-69

## Parameters, Methods, Reagent Sets and Ranges (Continued)

Parameters marked (USEPA) are USEPA-approved or accepted for reporting purposes; sample pretreatment may be required on some procedures. If no reagent set is listed for a parameter, order needed reagents and supplies separately. See the *Products for Analysis 2002* catalog, pages 297-320, or each procedure at [www.hach.com](http://www.hach.com) for more information.

Test	Method	Range	Cat. No.
Iron, Ferrous (AccuVac®)	1,10-Phenanthroline	0.02-3.00 mg/L	25140-25
Iron, Total (USEPA)*	FerroVer®	0.02-3.00 mg/L	21057-69
Iron, Total (AccuVac®) (USEPA)*	FerroVer®	0.02-3.00 mg/L	25070-25
Iron, Total	FerroZine®	0.009-1.400 mg/L	2301-66
Iron, Total	TPTZ	0.012-1.800 mg/L	26087-99
Iron, Total (AccuVac®)	TPTZ	0-1.80 mg/L	25100-25
Iron, Total	FerroMo™	0.01-1.80 mg/L	25448-00
Lead (LeadTrak®)	Fast Column Extraction	5-150 µg/L	23750-00
Manganese, LR	PAN	0.007-0.700 mg/L	26517-00
Manganese, HR (USEPA)*	Periodate Oxidation	0.2-20.0 mg/L	24300-00
Mercury	Cold Vapor	0.1-2.5 µg/L	26583-00
Molybdenum, Molybdate, LR	Ternary Complex	0.03-3.00 mg/L	24494-00
Molybdenum, Molybdate, HR	Mercaptoacetic Acid	0-50.0 mg/L	26041-00
Molybdenum, Molybdate, HR (AccuVac®)	Mercaptoacetic Acid	0-50.0 mg/L	25220-25
Nickel (USEPA)*	Heptoxime	0.02-1.80 mg/L	22435-00
Nickel	PAN	0.007-1.000 mg/L	26516-00
Nitrogen, Ammonia (USEPA)**	Nessler	0.02-2.50 mg/L	24582-00
Nitrogen, Ammonia	Salicylate	0.1-0.50 mg/L	26680-00
Nitrogen, Ammonia TNT, LR	Salicylate	0.02-2.50 mg/L	26045-45
Nitrogen, Ammonia TNT, HR	Salicylate	0.4-50.0 mg/L	26069-45
Nitrogen, Nitrate, LR	Cadmium Reduction	0.1-0.50 mg/L	24298-00
Nitrogen, Nitrate, MR	Cadmium Reduction	0.1-10.0 mg/L	21061-69
Nitrogen, Nitrate, MR (AccuVac®)	Cadmium Reduction	0.1-10.0 mg/L	25110-25
Nitrogen, Nitrate, HR	Cadmium Reduction	0.3-30.0 mg/L	21061-69
Nitrogen, Nitrate, HR (AccuVac®)	Cadmium Reduction	0.3-30.0 mg/L	25110-25
Nitrogen, Nitrate, HR TNT	Chromotropic Acid	0.2-30.0 mg/L	26053-45
Nitrogen, Total Kjeldahl*	Nessler	1-150 mg/L	24953-00
Nitrogen, Total Inorganic TNT	Titanium Reduction	0.2-25.0 mg/L	26049-45
Nitrogen, Total, LR TNT	Persulfate Digestion	0.5-25 mg/L	26722-45
Nitrogen, Total, HR TNT	Persulfate Digestion	10-150 mg/L	27141-00
Nitrogen, Nitrite TNT	Diazotization	0.003-0.500 mg/L	26083-45
Nitrogen, Nitrite, LR (USEPA)	Diazotization	0.002-0.300 mg/L	21071-69
Nitrogen, Nitrite, LR (AccuVac®) (USEPA)	Diazotization	0.002-0.300 mg/L	25120-25
Nitrogen, Nitrite, HR	Ferrous Sulfate	2-250 mg/L	21075-69
Oxygen Demand, Chemical (USEPA)***	Reactor Digestion	3-150 mg/L	21258-25 <sup>†</sup>
Oxygen Demand, Chemical, HR (USEPA)	Reactor Digestion	20-1500 mg/L	21259-25 <sup>†</sup>
Oxygen Demand, Chemical, HR Plus	Reactor Digestion	200-15,000 mg/L	24159-25 <sup>†</sup>
Oxygen Demand, Chemical, Mn III	Manganese III	30-1000 mg/L	26234-25 <sup>†</sup>
Oxygen, Dissolved, HR (AccuVac®)	HRDO	0.3-15.0 mg/L	25150-25
Oxygen, Dissolved, LR (AccuVac®)	Indigo Carmine	6-800 µg/L	25010-25
Oxygen, Dissolved, SHR (AccuVac®)	SHRDO	1.0-40.0 mg/L	25150-25
Oxygen Scavengers	Iron Reduction	varies/analyte	24466-00
Ozone, LR (AccuVac®)	Indigo Trisulfonate	0.01-0.25 mg/L	25160-25
Ozone, MR (AccuVac®)	Indigo Trisulfonate	0.01-0.75 mg/L	25170-25
Ozone, HR (AccuVac®)	Indigo Trisulfonate	0.01-1.50 mg/L	25180-25
Phenols (USEPA)**	4-Aminoantipyrine	0.002-0.200 mg/L	22439-00

\*\*\* DR/2500 only

## Parameters, Methods, Reagent Sets and Ranges (Continued)

Parameters marked (USEPA) are USEPA-approved or accepted for reporting purposes; sample pretreatment may be required on some procedures. If no reagent set is listed for a parameter, order needed reagents and supplies separately. See the *Products for Analysis 2002* catalog, pages 297-320, or each parameter at [www.hach.com](http://www.hach.com) for more information.

Test	Method	Range	Cat. No.
Phosphonates	Persulfate/UV Oxidation	0-2.50 to 0-125 mg/L	24297-00
Phosphorus, Reactive	Molybdovanadate	0.09-45.0 mg/L	20760-32
Phosphorus, Reactive (AccuVac®)	Molybdovanadate	0.09-45.0 mg/L	25250-25
Phosphorus, Reactive TNT (USEPA)	PhosVer® 3	0.01-5.00 mg/L	27425-45
Phosphorus, Acid Hydrolyzable TNT	PhosVer® 3	0-5.00 mg/L	27427-45
Phosphorus, Reactive, HR	Amino Acid	0.04-30.00 mg/L	22441-00
Phosphorus, Reactive (USEPA)	PhosVer® 3	0.02-2.50 mg/L	21060-69
Phosphorus, Reactive (AccuVac®) (USEPA)	PhosVer® 3	0.02-2.50 mg/L	25080-25
Phosphorus, Reactive, LR RL	Ascorbic Acid	9-3,000 µg/L	26786-00
Phosphorus, Reactive, HR RL	Molybdovanadate	0.3-45.0 mg/L	20760-49
Phosphorus, Reactive, HR TNT	Molybdovanadate	1.0-100.0 mg/L	27673-45
Phosphorus, Total TNT (USEPA)	Ascorbic Acid	0.06-3.5 mg/L	27426-45
Phosphorus, Total TNT	Molybdovanadate	0.0-100.0 mg/L	27672-45
Potassium	Tetraphenylborate	0.1-7.0 mg/L	24591-00
Quaternary Ammonium Compounds	Direct Binary Complex	0.2-5.0 mg/L	24592-00
Selenium	Diaminobenzidine	0.01-1.00 mg/L	22442-00
Silica, ULR	Heteropoly Blue	3-1000 µg/L	25535-00
Silica, ULR RL	Heteropoly Blue	3-1000 µg/L	26785-00
Silica, LR	Heteropoly Blue	0.01-1.600 mg/L	24593-00
Silica, HR	Silicomolybdate	1.0-100.0 mg/L	24296-00
Silver	Colorimetric	0.005-0.700 mg/L	22966-00
Sulfate (USEPA)	SulfaVer® 4	2-70 mg/L	21067-69
Sulfate (AccuVac®) (USEPA)	SulfaVer® 4	2-70 mg/L	25090-25
Sulfide (USEPA)	Methylene Blue	5-800 µg/L	22445-00
Surfactants, Anionic	Crystal Violet	0.002-0.275 mg/L	24468-00
Suspended Solids	Photometric	0-750 mg/L	-
Tannin & Lignin	Tyrosine	0.1-9.0 mg/L	22446-00
Total Organic Carbon, LR	TNT Method	0.3-20 mg/L	27603-45
Total Organic Carbon, MR	TNT Method	15-150 mg/L	28159-45
Total Organic Carbon, HR	TNT Method	100-700 mg/L	27604-45
Tolyltriazole	UV/Photolysis	1-16 mg/L	21412-99
ToxTrak™ Toxicity	Colorimetric	0-100% Inhibition	25972-00
Volatile Acids	Esterification	27-2800 mg/L	22447-00
Zinc (USEPA)*	Zincon	0.01-3.00 mg/L	24293-00

\* Order COD Reactor separately

\* Requires digestion

\*\* Requires distillation

USEPA means the procedure meets all requirements of the applicable U.S. Environmental Protection Agency approved method or has been approved as an alternate test procedure.

LR= Low Range; MR = Mid Range; HR = High Range; SHR = Super High Range; ULR = Ultra Low Range

AV = AccuVac®; RL = Rapid Liquid; TNT = Test 'N Tube™

## DR/2500 Technical Specifications:

**Wavelength Range:** 365–880 nm  
**Bandwidth:** 4 nm  $\pm$  1 nm  
**Wavelength Accuracy:**  $\pm$  1 nm, 400–700 nm  
**Wavelength Resolution:** 1 nm  
**Wavelength Selection:** Automatic  
**Wavelength Scan Speed:** 200 nm/minute  
**Optical System:** Concentric Spectrometer  
**Wavelength Calibration:** Automatic at power-up  
**Photometric Range:** –3.2 to 3.2 Abs  
**Photometric Resolution:** 0.001 Abs  
**Photometric Linearity:** 5mA from 0.0 to 0.5 Abs;  $\pm$  1% from 0.5 to 2.0 Abs  
**Calibration Interval:** One year recommended  
**Stray Light:** >2.5 A, <0.3% T @ 400 nm  
**Light source:** Low voltage Tungsten, UV discharge lamps and Light Emitting Diode (LED)  
**Bulb life:** Life of instrument  
**Power source:** Automatic selectable 95 to 240 VSAC, 50/ 60 Hz  
**Display:** Backlit, graphic LCD also serves as graphic user interface via touch  
**Operational Modes:** Selectable: momentary, constant on  
**Readout Modes:** Transmittance, absorbance, concentration, pH, mV, and temperature, plus optional wavelength scan and time course graphs  
**pH Input:** sension™ 5-pin connector  
**RS–232 Output:** Standard 9-pin bi-directional  
**Parallel Printer:** Standard 25-pin  
**Line Power:** 9 Vdc @ 1 amp; 95 to 240 Vac; 50/60 Hz; Automatic Selection  
**Battery Backup:** Automatically rechargeable for 15-minute backup operation  
**Cell Compatibility:** 9-mm to 1-inch round, including COD/Test 'N Tube™ vials; AccuVac® (1-inch round); immunoassay vials; and 1, 2, 5 x 1-cm cuvettes  
**Interface:** Graphic user interface 320 x 240 pixel graphic display with touch screen  
**Data Storage:** 1000 data points (date, time, results, sample ID, user ID), 10 wavelength scan graphs, 10 time course graphs, 50 user calibrations  
**Dimensions:** 19 x 38 x 13.5 cm nominal  
**Enclosure:** meets IP32 rated (splash proof)  
**Weight:** 1.95 kg  
**Keypad:** 5 keys for power on/off, backlight on/off, contrast down, contrast up, and pH  
**Printer Port:** External serial or parallel  
**Pour-Thru Cell:** 1-inch (optional)  
**Operating Environment:** 10 to 40°C (50 to 104°F); 85% relative humidity, non-condensing  
**Storage Environment:** –10 to 60°C (14 to 140°F); 85% relative humidity, non-condensing  
**Report Generation:** Download stored information in a standard report format. Meets GLP guidelines, including a minimum of: date, time, sample identification tag, analyst initials (3), results, and instrument serial number  
**Real-time Clock:** Yes  
**Real-time Calendar:** Yes  
**pH Range:** –2.00 to 19.99  
**pH Resolution (selectable):** 0.001/0.01/0.1  
**pH Slope (meter allowable):** 48–65mV/decade  
**mV Range:** –2000 to 2000 mV  
**mV Resolution:** 0.1 mV  
**Accuracy (meter only):**  $\pm$  1 mV,  $\pm$  0.05% of the mV reading, whichever is greater  
**Temperature Probe Reading Range:** –10 to 110°C (can also display °F)  
**Temperature Probe Reading Resolution:** 0.1°C  
**Temperature Probe Reading Accuracy:**  $\pm$  1.0°C

## DR/2400 Technical Specifications:

**Wavelength Range:** 400–880 nm  
**Bandwidth:** 4 nm  $\pm$  1 nm  
**Wavelength Accuracy:**  $\pm$  1 nm, 400 – 880 nm  
**Wavelength Resolution:** 1.0 nm  
**Wavelength Selection:** Automatic  
**Wavelength Scan Speed:** 200 nm/minute  
**Optical System:** Concentric Spectrophotometer  
**Wavelength Calibration:** Automatic at power-up  
**Photometric Range:** –3.2 to 3.2 Abs  
**Photometric Resolution:** 0.001 Abs  
**Photometric Linearity:** 5mA from 0.0 to 0.5 Abs;  $\pm$  1% from 0.5 to 2.0 Abs  
**Calibration Interval:** One year recommended  
**Stray Light:** > 2.5 A, <0.3 %T @ 430 nm  
**Light source:** Low-voltage Tungsten and Light Emitting Diode (LED)  
**Bulb life:** Life of instrument  
**Power source:** 9 Volt DC Automatic selectable 95 to 240 Vac 50/60Hz  
**Display:** Backlit, graphic LCD also serves as graphic user interface via touch  
**Operational Modes:** Selectable: momentary, constant on  
**Readout Modes:** Transmittance, Absorbance, Concentration  
**RS232 Output:** Standard 9-pin bi-directional  
**Parallel Printer:** Standard 25-pin  
**Line Power:** Converter included  
**Battery Power:** 3 'D' cell batteries included; optional rechargeable battery pack  
**Cell Compatibility:** 25 mm round (AccuVac® Vials); COD/Test 'N Tube™/Unicell® vials; 1-cm square; 1-cm x 1-inch dual pathlength  
**Interface:** Graphic user interface 320x240 pixel graphic display; test prompting selectable in English, French, German, and Spanish  
**Data Storage:** 1000 data points (date, time, results, sample ID, user ID)  
**Dimensions:** 32 x 17.8 x 18.7 cm nominal  
**Enclosure:** IP 32 rated (splash proof)  
**Weight with battery:** 2.26 kg nominal  
**Keypad:** 5 keys for power on/off, backlight on/off, contrast down, and battery status  
**Printer Port:** External serial  
**Pour-Thru Cell:** 1-inch (optional)  
**Operating Environment:** 0 to 40°C; 90% relative humidity, non-condensing  
**Storage Environment:** –25 to 60°C; 90% relative humidity, non-condensing  
**Report generation:** Download stored information in a standard report format. Meets GLP guidelines, including a minimum of: date, time, sample identification tag, analyst initials (3), and concentration.  
**Real time clock:** Yes  
**Real time calendar:** Yes

## How to Order:

### DR/2500

- 59000-00** DR/2500 Scanning Spectrophotometer- includes 2 1-inch round sample cells, round sample cell holder, printed instrument and procedures manuals, CD-ROM (instrument and procedure manuals), and DR/Check Standards.
- 59000-02** DR/2500 Scanning Spectrophotometer - same as above with Euro Power Cord

### DR/2400

- 59400-00** DR/2400 Portable Spectrophotometer- includes six 1-inch sample cells, a 16-mm vial adapter, instrument and procedure manuals (printed and CD-ROM), line power converter
- 59400-02** DR/2400 Portable Spectrophotometer - same as above with Euro Power Cord

### DRELS

- 28318-00** DR/2400 Portable Spectrophotometer with hard-side carrying case; order reagents and apparatus separately as needed
- 28326-00** DR/2400 Basic Water Quality Reagent and Apparatus Laboratory - includes spectrophotometer, carrying case, reagents, and apparatus for 18 of the most basic water testing parameters
- 28266-00** Basic Water Quality Reagent Set
- 28265-00** Water Quality Apparatus Set (for Basic and Complete Labs)
- 28327-00** DR/2400 Complete Water Quality Reagent and Apparatus Laboratory - includes spectrophotometer, carrying case, reagents, and apparatus for 24 water quality parameters
- 28447-00** DR/2400 Complete Water Quality Reagent and Apparatus Laboratory - includes spectrophotometer, carrying case, reagent and apparatus for 24 water quality parameters. Also includes the sension™ 156 meter (can test pH, dissolved oxygen and conductivity) and the 2100P portable turbidimeter
- 28264-00** Basic Water Quality Reagent Set
- 28265-00** Water Quality Apparatus Set (for Basic and Complete Labs)
- 23825-00** DR/2400 Industrial Water Quality Reagent and Apparatus Laboratory - includes spectrophotometer, carrying case, reagents, and apparatus for 25 industrial water parameters
- 28268-00** Industrial Water Quality Reagent Set
- 28267-00** Industrial Water Quality Apparatus Set
- 54651-10** sension™ 156 with platinum pH and conductivity probes (optional)
- 46500-00** 2100P Portable Turbidimeter (optional)

### Replacement Parts:

- 18010-00** Power Cord, UL listed
- 46836-00** Power Cord, VDE (Euro) certified
- 59017-00** Power Supply (line power converter), 100-240V, 9Vdc, 18w

### Optional Accessories:

- 49665-00** HachLink™ 2000 Software (each)
- 48129-00** Cable, computer interface (each)
- 27639-00** DR/Check Absorbance Standards Kit
- 24102-00** Sample Cells 1-inch (25.4 mm) round, polystyrene, with caps (2/pkg)
- 20951-00** Sample Cells, 1-cm microcell, glass, matched pair (2/pkg)
- 26295-00** Sample Cells, 1-cm microcell, plastic, disposable (100/pkg)
- 59122-00** Pour-Thru Cell Kit for the DR/2500
- 59404-00** Pour-Thru Cell Kit for the DR/2400

Lit. No. 6206  
A315 Printed in U.S.A.  
©Hach Company, 2003. All rights reserved.

To order, call 800.227.4224, place your order online at [www.hach.com](http://www.hach.com), or e-mail [orders@hach.com](mailto:orders@hach.com). For a quote, fill out the quotation form on our web site at [www.hach.com](http://www.hach.com) and we'll get you the information you need, usually within 24 hours.

For current price information, technical support and ordering assistance, contact the Hach representative serving your area.

In the United States, contact:

**HACH COMPANY**  
P.O. Box 389  
Loveland, Colorado 80539-0389  
U.S.A.  
Telephone: 800-227-4224  
Fax: 970-669-2932  
E-mail: [orders@hach.com](mailto:orders@hach.com)  
<http://www.hach.com>

For international inquiries, contact:

**HACH COMPANY**  
P.O. Box 389  
Loveland, Colorado 80539-0389  
U.S.A.  
Telephone: 970-669-3050  
Fax: 970-461-3939  
E-mail: [intl@hach.com](mailto:intl@hach.com)  
<http://www.hach.com>

