

# Photometry

## Straightforward measuring!

Depending on your application, WTW offers the appropriate photometer and the appropriate test sets. Photometers and tests are perfectly matched to each other. The methods for all test sets are stored in the photometers.

## Cuvette tests without barcode

### Powder tests

Small but nice – the powder tests for field use

p. 94



## pHotoFlex®

... precision for all-purpose use

### pHotoFlex®

p. 88



## Cases / Sets

The mobile lab for field use

p. 90



## LabStation

The small lab solution: pHotoFlex® plus LabStation

p. 90



*photoLab® & spectroFlex*  
... utmost precision for lab use

photoLab®  
p. 86

**NEW**

spectroFlex  
p. 82

Thermoreactors

The convenient and  
safe way to digestions  
p. 92

Reagents/  
accessories  
p. 94 / 103





# Systematic and spectral analysis – Routine measurement and photometric testing

Photometric identification can be split into two groups.

The **routine measurement** of measurement parameters – also known as systematic analytics – enables to display the measuring values of each parameter promptly thanks to the stored methods for test kits. The reagent of the test kit is transformed by the substance to a measurable colour. The coloration is caused by the absorption of certain light particles (wavelengths) of the white light. The wavelength is measured at the highest absorption.

Such routine measurements are standard tasks for controlling wastewater, drinking water or environmental monitoring.

Photometer and optimized test kits for various measuring areas complete a perfectly harmonizing system. The programmes of each test kits called methods, may not be identical with each photometer model through optical and light related differences.

**Spectral analytics** is especially dedicated for studies of (unknown) substances, development of own methods and for optimizing testing systems: For i. e. determining the absorption maximum and therefore the suitable wavelength for test systems, spectra are run over a wider wavelength range. Insofar the highest and most suitable absorption is identified. Additionally testings such as enzyme kinetics or multi-wavelength measurements can also be processed.



# Portable and Accurate: The pHotoFlex<sup>®</sup>, photoLab<sup>®</sup> and spectroFlex series

In order to choose the appropriate instrument, the following should be considered:

Mobile measuring	Measuring in laboratory environment
<b>With pHotoFlex<sup>®</sup> and pHotoFlex<sup>®</sup> Turb</b> For fast and accurate measurements in the field consider these features: <ul style="list-style-type: none"> <li>• low power consumption</li> <li>• robust</li> <li>• mobile</li> <li>• precise</li> </ul> These requirements are met by a special optical system working with a combination of LED and filters. The robustness of the portable pHotoFlex <sup>®</sup> instruments is due to the low warming and to the longer lifespan of the LEDs utilized. With two cuvette sizes, these photometers allow for all common tests and offer a wide measuring range. The optional LabStation allows the user to conveniently download results collected in the field to a computer back at the lab.	<b>With photoLab<sup>®</sup> S6/S12 and spectroFlex</b> Highest demands are considered to be the basis for research, routine measurements and "calculation charges". Therefore, the instruments have to offer: <ul style="list-style-type: none"> <li>• AQS/IOK</li> <li>• accurate measuring</li> <li>• wide measuring ranges</li> <li>• comfort features, e.g. test and cuvette recognition</li> </ul> A complex optical system and a short warm up time guarantee constant measuring conditions. The constant power supply allows the use of bar-codes. The optical system and rectangular cuvettes up to 50 mm allow wide measuring ranges reaching up to trace elements analysis. The largely constant temperature in the lab allows extensive presettings for the methods, thereby providing a higher user comfort. Additionally, using spectroFlex 6100 and 6600 the following tasks can be accomplished: <ul style="list-style-type: none"> <li>• Measurements from 190 – 100 nm</li> <li>• AQA extended for matrix check and larger user groups</li> <li>• Scans (spectra), kinetics and multi-wavelength measurements</li> <li>• Data transfer via USB and USB hub into larger user communities</li> </ul>

## What are the common features of all series?

- Proven quality, adapted to the respective use
- Highest accuracy corresponding to the used optical system
- A large selection of cuvettes and outstanding instrument features for a simple use of the cuvettes.

Application Photometers						
Application range	Portable Photometers		Laboratory Photometers			
	pHotoFlex <sup>®</sup>	pHotoFlex <sup>®</sup> Turb	photoLab <sup>®</sup> S6	photoLab <sup>®</sup> S12	spectroFlex 6100	spectroFlex 6600
Application areas	Environmental monitoring, water treatment, beverage industry, wine industry, process control, multi-parameter applications for photometry, pH and turbidity.		Routine measurements in wastewater and drinking water, optional field use	Routine measurements in wastewater and drinking water, comprehensive laboratory testes, optional field use	Spectral and special analysis in industry, education and science and analysis of routine measurements with standard parameters in waster water and drinking water as well as environmental analysis.	
Wavelengths	6 wavelengths: 436, 517, 557, 594, 610, 690 nm	6 wavelengths: 436, 517, 557, 594, 610, 690, 860 nm	6 wavelengths: 340, 445, 525, 550, 605, 690 nm	12 wavelengths: 340, 410, 445, 500, 525, 550, 565, 605, 620, 665, 690, 820 nm	320 nm – 1100 nm (VIS), freely definable	190 nm – 1100 nm (UV-VIS), freely definable
Optical system	LED with filters		Filter/Reference beam	Filter/Reference beam	Monochromator/Single Beam + AutoCheck	
Special functions	pH measurement	pH measurement, Turbidity (IR)	—	Kinetics	Spectra, kinetics, multi wave length measurements, graphical evaluation of data, environmental parameters with routine and special tasks with AQA support, PC-Software for easy data management, input and transfer	
optional: LabStation for easy operation and laboratory evaluation with software and barcode reader support						
User-defined methods	100		No	50	100, 20 profiles	
Cuvettes	Round: 16 mm (height: 91 – 104 mm), 28 mm		Round 16 mm	Round / rectangular 10, 20, 50 mm	Round and rectangular 10, 20, 50 mm	

**NEW**

# The spectroFlex series

## Spectral analysis universal and flexibel

The spectrophotometer of the spectroFlex series for the VIS and UV/VIS range offer the unique combination of systematic and spectral analytics with the established analytical quality assurance AQA and the convenience provided by the filter photometer.

### spectroFlex<sup>SERIES</sup>

- 190 – 1100 nm
- Innovative optics
- Intuitive operating
- Extensive AQA

Thanks to state-of-the-art technology all spectroFlex models convince with optimized operation handling – fast, direct and intuitive:

- Menu navigation through all applications
- Large graphic display, backlit
  - for concise operation with menu structured processes
  - graphical evaluation.
- Direct access to functionalities via function keys for standard functions such as i.e. menu related settings, dilution, quotation mode



Select method (all)				08/08/07 10:40
<input type="text"/>				
4	N2/25	NO <sub>3</sub> -N	0.5 - 25.0 mg/l	▲
5	N5/25	NO <sub>2</sub> -N	0.010 - 0.700 mg/l	
6	P6/25	PO <sub>4</sub> -P	0.05 - 5.00 mg/l	
7	P7/25	PO <sub>4</sub> -P	0.5 - 25.0 mg/l	
14	14540	COD	10 - 150 mg/l	
15	FB436	DFZ	0.5 - 50.0 m <sup>-1</sup>	
17	14554	Ni	0.10 - 6.00 mg/l	
18	14785	Ni	0.10 - 5.00 mg/l	
21	IodFa	IFZ	1.0 - 50.0 IFZ	
23	14541	COD	25 - 1500 mg/l	▼
Last used				

Edit method		03/28/08 12:05
Number		1001
Designation		
Version		1.00
Wavelength		320 nm
Cell		16 mm
Citation form		
Unit		mg/l
Resolution		0.01
Calibration curve		Measure standard solutions
		Method list   Delete   Next

- Selection tables for most convenient selection and search of data, parameters, methods etc.
- Data filter for selective choice of measuring data sets
- Masks for easy handling and measuring of user defined methods
- USB for all data transfers

## Systematic analysis – routine measurement with test kits

Especially important for standard duties with routine measurements (*see p. 80*) are rapidness, precision and comfortable data transfer. For these challenges **spectroFlex** offers well proven and new functionalities:

- **AutoCheck** for highest precision
- The proven combination of round and rectangular **cuvette** slots
- Automatic **cuvette** recognition for fast and effective handling
- Integrated **barcode recognition** for round and rectangular **cuvettes** with elimination of cuvette failures and prompt start of measuring
- More than 150 methods\* for commercial test kits
- Direct methods such as SAC, colour etc.
- 3 parallel timer

\*(during 2008)



## Analytical Quality Assurance (AQA) – From own monitoring to larger laboratories

The instrument supported Analytical Quality Assurance has become a must for all industry branches, in order to guarantee plausible and correct measuring results. The **spectroFlex** series supports the AQA for checking the instrument and individual routine measurements. The administration of user groups for larger laboratory environments including administrative, user and guest profiles is also supported. The AQA can be switched on or off.

### AQS

- Extensive test fluids
- MatrixCheck
- Extended user administration

- Calibration intervals for instrument and test
- **PhotoCheck**: Instrument check including linearity at 3 wavelengths and 4 measuring points
- Grey filter and UV-VIS test standards
- Standards for single parameters and combines checks
- Matrix check with spiking

AQA2 setup	08/16/07 18:25
General	
Mode	Measurements
Lock methods	Yes
Method	6: P6/25
AQA2	AQA2 inactive
Interval	50 Measurements
Target value	0.80 mg/l PO <sub>4</sub> -P
Tolerance	0.08 mg/l PO <sub>4</sub> -P
Standard ID	
Method	Apply



PhotoCheck

Parameter

pH

ORP

ISE

Oxygen (D.O.)

Conductivity

Multi-parameter

BOD/Respiration

Photometers

Turbidity

Colony Counter

Software/Printers

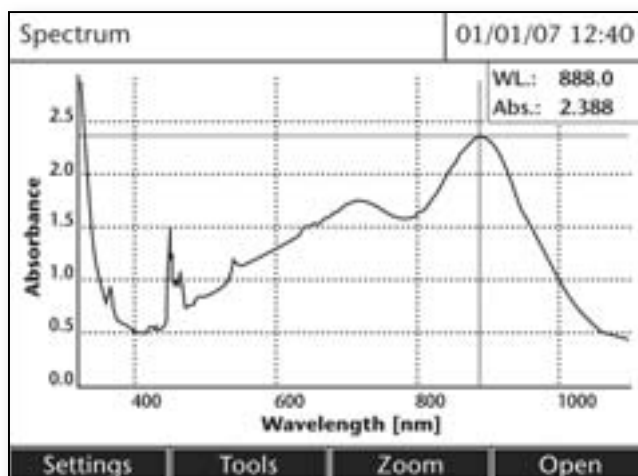


## Spectral analysis – For user-defined methods, spectra and kinetics

All user specific laboratory applications and special tasks are made easy by the menu navigated instruction and various additional functions:

- **100 user-defined methods**  
Via selection tables linear and non-linear applications can be measured, supported by the AQA (over pairs of variates or functions)
- **Spectra:**  
Over a definable wavelength area with graphical evaluation
- **Multi-wavelength measurement:**  
Up to 4 different wavelengths
- **Kinetics:**  
With a maximum or free selectable number of measurements
- Time interval and start delay are adjustable

The settings can be stored in 20 profiles each and recalled when required. The storage capacity of 4 MB can store approx. 100 spectra of 300 – 900 nm and 400 kinetics sets with each of 150 measuring values.



## Data management with USB via cable or stick

spectroFlex is equipped with 3 interfaces: USB-A for printer, barcode reader, USB stick, USB-B for PC connection and a RS 232 interace. Therefore, the data transfer via USB stick or cable is extremely comfortable both ways:





- Measurement data sets
- Spectra and kinetics data
- Software updates
- Methode updates

The data can be transferred to a PC and printer or via USB hub into a larger environment. Also sample identification numbers can be read by connecting an external barcode reader. An optional software for easy data processing is available for the PC.



## spectroFlex en-route – mobile operation

A spectrophotometer's regular operation place is the laboratory, although it can be quite practical at some times, when an instrument can also be operated on-site at a measuring station. The light-weight and easy to handle spectroFlex models enable this mobile operation. Most important is a careful transportation, a protected measuring venue and an especially good measuring preparation regarding heating period and zeroing after transportation! Besides the transportation case, the accessories include a 12 V adapter cable for a common car storage battery.

Technical Data spectroFlex		
Model	spectroFlex 6100 (VIS)	spectroFlex 6600 (UV/VIS)
Wavelength range	320 – 1100 nm	190 – 1100 nm
Technique	Single Beam with AutoCheck	
Lamp	Tungsten	Xenon Flashlamp
Wavelength resolution / accuracy	1 nm; ± 1 nm	
Scan speed	Approx. 334 nm/min resp. 5.6 nm/sec	Approx. 455 nm/min resp. 7.6 nm/sec
Band width	4 nm	
Test recognition	Automatic test recognition via barcode for all cuvette types with automatic measurement start	
Absorbance range	-3.3 ...+3.3 Abs	
Photometric resolution	0.5% of measurement value or 0.005 Abs at Extinction 2	
Photom. reproducibility	± 0.002 E @ 1 E (or better)	
Photometric accuracy	0.003 E for E < 0.600 E 0.5% or value or 0.600 E - 2.000 E	
Photometric linearity	< 1% up to 2.000 A at 340 - 900 nm	
Stray light	< 0.1% at 340 and 408 nm	
Cuvette recognition	Automatically for all cuvette types: round 16 mm, 10, 20, 50 mm w/o adapter	
Measurement modes	Concentration, Absorbance, Transmission, Kinetics and Spectra with Absorbance, %Transmission, Multi-Wavelength measurement	
Display	Graphical display with backlight for enhanced graphical evaluation of data	
Storage	1000 measurement values; spectra and kinetics approx. 4 MB => 100 spectra (300 – 900 nm) and 400 kinetics with 150 values	
Methods and profiles	More than 200 methods (Q4/2008), 100 user defined methods, 20 profiles each for kinetics and absorption spectra	
Update	Via internet with PC, USB stick	
Interfaces	1 USB-A for USB stick, printer, barcode reader, 1 USB-B for PC, 1 RS 232 for serial connection of printer/PC	
Approvals	cETLus (= UL), CE	
Protection class	IP 30 and protecting rinse for optical slot	
Power supply	Universal plug	
Temperature range	Use between +50 °F and +95 °F (+10 °C and +35 °C, ) storage: -13 °F up to +149 °F (-25 °C up to +65 °C)	
Dimensions (W x H x D)	15.9 x 7.8 x 12.4 in. (404 x 197 x 314 mm)	
Weight	Approx. 9.9 lb (4.5 kg without plug-in power supply)	
Accessories	PC software for easy data evaluation (Q2/2008), cable for portable car battery (12 V) , transportation case	
Ordering Information		
Model		Order No.
spectroFlex 6100	Spectrophotometer (VIS) for spectral and routine analysis in the range of 320 - 1100 nm	250 201
spectroFlex 6600	Spectrophotometer (UV/VIS) for spectral and routine analysis in the range of 190 - 1100 nm	250 202
SFdata	PC software for easy data evaluation (spectroFlex)	902 761
FC spectroFlex	Field case for spectroFlex series	250 212
ADA 12V	12 V car adapter cable for operation of spectroFlex	902 760
   		



# The photoLab® series – Immediate and high precision measuring!

The photoLab® filter photometers offer laboratory precision in combination with highest comfort and fastest measuring speed. This becomes especially valuable in routine operation:

**Open the lid, insert the cuvette, read the measuring value without delay!**

## photoLab® Serie

- AQA/IQC, multistage
- Automatic cuvette identification
- Barcode recognition for all cuvette types

Speed and accuracy originate from the used filter technology with reference beam technique. Combined with barcoded round and rectangular cuvette tests utmost efficient and cost-saving measuring is made possible for all demands. The given wavelengths by high-precision filters do not require any mechanics and therefore make this measuring instrument practically a maintenance free unit.

- Auto Check for highest stability and precision
- Automatic cuvette recognition for all used cuvette types
- Automatic test recognition through integrated barcode reader
- Automatic measuring start
- Automatic Quality Assurance AQA
- Broad selection of programmed test kits



## photoLab® S6

The filter photometer with 6 wavelengths for all common routine determinations with the round reaction cuvettes for wastewater and drinking water analysis.

The instrument is therefore easy and straight-forward for:

- sporadic, single measurements
- using reaction cuvettes for fast measuring results
- standard measurements with easy storage

## photoLab® S12

Filter photometer with 12 wavelengths for an extensive routine operation in service laboratories and for education. Besides the barcoded reaction test kits, there is also a considerable number of reasonable reagent test kits available for rectangular cuvettes. Uniquely, the barcode support also comes with the test kits for 10 mm, 20 mm and 50 mm rectangular cuvettes. Especially within the drinking water analysis even trace concentrations are covered.

The instrument is therefore highly efficient and cost-saving for:

- routine determinations with a large number of samples
- measuring of smallest concentrations
- special tasks with user-defined methods

The additional characteristic for own routine and kinetics measurements make this instrument suitable for servicing business units and education.

### Technical Data photoLab®

Model	photoLab® S6 and S6-A	photoLab® S12 and S12-A
Type	Filter Photometer	Filter Photometer
Photodiode array for	6 wavelengths	12 wavelengths
Wavelengths, nm	340, 445, 525, 550, 605, 690	340, 410, 445, 500, 525, 550, 565, 605, 620, 665, 690, 820
User-defined methods	–	50
Auto-zero adjustment	Yes	Yes
AutoSelect-function	Yes	Yes
Cuvette recognition	Yes	Yes
Cuvette type	Round	Round, 10 mm, 20 mm and 50 mm
Data storage and time	500 data sets with date and time	1000 data sets with date and time
Essential functions	Concentration, absorption and transmission measurement, AQA/IQC, RS 232 interface	Concentration, absorption and transmission measurement, AQA/IQC, Kinetics, RS 232 interface
Operation with rechargeable batteries (optional)	1 working day, total discharge protection, maintenance charging during mains operation	1 working day, total discharge protection, maintenance charging during mains operation
Test marks	CE, UL, CUL	CE, UL, CUL
Warranty	2 years	2 years

### Ordering Information

Model		Order No.
photoLab® S6	Mains operated version, 230 V European standard plug	250 013
photoLab® S6-A	Version with rechargeable batteries, 230 V European standard plug	250 022
photoLab® S12	Mains operated version, 230 V European standard plug	250 024
photoLab® S12-A	Version with rechargeable batteries, 230 V European standard plug	250 026



*Note: versions for other mains supplies/countries on request*

# pHotoFlex®: The Portable Photometers

The pHotoFlex® series offers most robust optics, combining precision with low power consumption achieved through optical filters together with the LEDs. The instruments are equipped with 6 wavelengths. Additionally, the pH measuring and the optional turbidity measuring (IR range) are integrated! This makes these instruments the perfect partner for all measurements on site: in a wastewater plant for wastewater and reference measurements, in drinking water analysis at a well-head or in a cistern and finally for monitoring water bodies generally. They are handy, low current and offer many extra features at the same time:

## pHotoFlex® Series

- Precise
  - Versatile
  - Robust
- The smart adapter solution for operating different cuvette types: Flip the adapter:  $\varnothing$  28 mm and 16 mm from 92 up to 104 mm
  - Backlit display with automatic switch-off
  - User guidance via display for easy operation without handbook reading
  - Large selection of test sets for all requirements
  - Integrated pH measurement with automatic temperature compensation
  - Turbidity measurement with infrared light source according to DIN 27027/ISO 7027
  - 100 program storage places for user-defined routine measurements

The menu navigation leads all the way through the measuring tasks also allowing to select 10 of the most frequently used test sets out of a favorite list and when necessary all other test sets can also be traced. In order to further enhance on-site work, there is a field case with integrated "laboratory tray" (see p. 90).

Ideal: with the LabStation and LSdata measurements and data evaluation can also be processed in the laboratory (see p. 90).



The constant ambient conditions supply a permanent power supply for comfortable operation via barcode and without repeated zeroing. Barcodes are included in the analysis regulations.



## pHotoFlex® – portable photometer with pH

The portable photometer pHotoFlex® demonstrates its capability with complex tasks in environmental and process monitoring at changing locations.

### pHotoFlex®

- More than 150 methods available
- Integrated pH measurement
- Color measurements



with pH sensor SenTix® 41

### pH function

The integrated pH function allows measurements of pH 0 ... 16 with automatic buffer recognition (TEC/NIST). Temperature compensation is automatic within the permitted range of 23 ... 212 °F (– 5 ... 100 °C). WTW's MultiCal®-routine allows the automatic calibration with up to 3 calibration points. WTW offers a large selection of pH

sensors as an optional accessory: For field use, the maintenance-free SenTix® 41 is recommended, whereas for precision measurements in the laboratory, the SenTix® 81 glass electrode should be used. The electrodes are described in detail in the pH measuring chapter (from p. 17 onward).

## pHotoFlex® Turb – Total Capability

The pHotoFlex® Turb is analogous to the pHotoFlex®, but has additionally an infrared (IR) light source for nephelometric turbidity measurement (90°), according to the requirements of DIN 27027/ISO 7027.

The calibration with the supplied AMCO® standards can be documented and output via RS232 like the measured data.

The AMCO standards enable highest precision also for the sensitive area of drinking water.

### pHotoFlex® Turb

additionally:

- Turbidity measurement according to DIN 27027/ ISO 7027
- 0-1100 NTU/FNU
- Calibration kit (0.02-10-1000 NTU)



## Field case set

- The “in-field laboratory”
- Integrated tray
- Convenient

### pHotoFlex® series in a convenient field case!

A small lab for in-field use. The integrated tray with placings for the instrument, cuvettes, measuring beaker and a stand for the pH electrode is particularly practical.

Complete sets with:

- pH electrode SenTix® 41 for all pHotoFlex® models
- 1 variable pipette with 5 ml volume for all pHotoFlex® models
- Calibration standards for pHotoFlex® Turb and Turb 430 IR/T
- Many useful accessories: empty cuvettes, buffer solutions with pH 4.01 and 7.00, PC cable AK Labor 540 B, stand for the pH electrode, cleaning tissues, screwdriver for battery change
- Space for other accessories



## LabStation plus LSdata

### The smart way of data management!

The LabStation upgrades the portable pHotoFlex® and Turb 430 models (see p. 110) to make it a small laboratory solution. With the new software package LSdata the measured data can be processed on a PC conveniently and according to GLP standards. The software is included in the delivery of the LabStation:

- Data export from the instrument to the PC according to GLP and with password protection
- Subsequent processing in Excel format, e.g. for clear documentation of individual sampling points
- Generation, administration and matching between instrument and PC of user-defined methods via dialogue window
- Calculation of calibration curve for user-defined methods



The LabStation also serves as charging station for the rechargeable battery set included in the delivery package. Alternatively a rechargeable battery set for pHotoFlex® and Turb 430 models is available separately.

**A useful note for field work:**

For taking along all necessary utensils, such as test kits and spray bottle with distilled water as well as a disposal container you can also pick a tool box from any from any building centre to perfectly suit your needs.



Technical Data		
Model	pHotoFlex®	pHotoFlex® Turb
Light source	LED	LED
Wavelengths nm	436, 517, 557, 594, 610, 690	436, 517, 557, 594, 610, 690 + 860
User-defined methods	100	100
Methods/Software update	Via Internet	Via Internet
Data storage	1000 data sets	1000 data sets
pH	0-16	0-16
Turbidity	—	0-1100 NTU/FNU
Accuracy	<b>Photometry</b> <2 nm wavelength accuracy, 0.005 abs. reproducibility <b>pH</b> ±0.01 pH <b>pH / Turbidity</b> —	< 2nm wavelength accuracy, 0.005 abs. reproducibility ±0.01 pH 0.01 NTU/FNU or ±2% of the measured value
Auto-zero adjustment/calibration:	With start of new method, with LabStation once a day 3 point	With start of new method, with LabStation once a day 3 point
Interface	RS 232, USB via adapter (optional)	RS 232, USB via adapter (optional)
Measuring parameters	Photometry, pH	Photometry, pH, Turbidity
Battery	Type AA batteries 4x1.5 V, for approx. 3000 measurements	Type AA batteries 4x1.5 V, for approx. 3000 measurements
Rechargeable battery	Optional: rechargeable battery or LabStation	Optional: rechargeable battery or LabStation
Test marks	cETLus	cETLus
Warranty	2 years	2 years

Ordering Information		
pHotoFlex®		Order No.
pHotoFlex®	Portable photometer with pH	251 100
pHotoFlex® Turb	Portable photometer with pH and turbidity	251 110
pHotoFlex®/SET	Portable universal LED filter photometer in a field case with tray to hold instrument and accessories	251 200
pHotoFlex® Turb/SET	Portable universal LED filter photometer with integrated turbidity measurement and pH functions in a field case with tray to hold instrument, calibration standard kit and accessories	251 210
FC pHotoFlex®/Turb 430	Field case with tray to hold instrument, for all pHotoFlex® and Turb 430 models	251 304
LS Flex/430	LabStation for all pHotoFlex® and Turb 430 models with LSdata software, rechargeable battery and universal mains adapter	251 301
RB Flex/430	Rechargeable battery for all pHotoFlex® models and Turb 430 IR/T with universal plug	251 300





# Thermoreactors

## Thermoreactors for COD and all other thermal Digestion Processes

Thermoreactors are required for the determination of COD, total nitrogen or total phosphorus. They ensure a complete digestion of the sample, as they maintain the necessary high reaction temperature throughout the whole of the defined period. For sample digestion three crack sets are available: crack set 10 (model 14687, 100 digestions) and crack set 10-C (model 14688, 25 cuvettes) for heavy metal, as well as crack set 20 for total nitrogen (model 14963, 90 determinations).

In each of the thermoreactors from WTW the most important temperatures and digestion times are stored in 7, easily selectable digestion programs. In addition to these 7 fixed standard programs, CR 3200 and CR 4200 thermoreactors allow you to store 8 of your own user-defined programs. Suitable for 16 mm cuvettes.

## Thermoreactors

- Programs for routine tests
- Rapid digestion for COD
- Quality assurance with separate sensor



CR 2200



CR 3200



CR 4200

## Fast digestion for CSB

### New programs for COD

For the COD digestion, the user can now select among 3 programs: 289.4 °F (148°C), 302 °F (150°C, according to US EPA) for 120 minutes and, at the request of many customers, a rapid digestion for 20 minutes at 298.4 °F (148 °C). This timespan has proven to be sufficient for many purposes in practice.

All reactors have timer functions. All reactors display when the reaction temperature is reached.

### Safety Precautions

All WTW thermoreactors optimize the heat transmission between the heating block and cuvettes as well as their superior safety. Apart from the built-in safety hood, which prevents chemicals from being splashed about should a cuvette break and the contact protection for the heating block surface.

### CR 2200

is ideal for anyone who needs to perform routine water analysis tests with small sample amounts, as 7 programs are available for digestion of 12 sample cuvettes at 212, 248 and 298.4 °F (100, 120, 148 and 150 °C).

### CR 3200

In addition, you can program the CR 3200 to carry out 8 of your individual digestions at freely selectable temperatures up to 338 °F (170 °C).

### CR 4200

is the right choice for anyone who needs to perform multiple tests simultaneously, such as COD (298.4 °F/148 °C) and total-N (248 °F/120 °C), as the two thermoblocks for 12 cuvettes each can be controlled separately. It also has memory for 8 of your own user-defined programs with free temperature selection up to 338 °F (170 °C).

### Temperature sensor TFK CR

#### Quality Assurance:

Quality assurance is constantly increasing in importance, even in the operational analysis sector. The CR 3200 and CR 4200 thermoreactors are both equipped with the external temperature sensor TFK CR (Order No. 250 100) as a testing aid. This temperature sensor can be plugged into the interface in place of a cuvette and the set and actual temperatures can be outputted either to a printer or a PC. This means that the function can not only be monitored, but also documented.

## Application Areas and Technical Data Thermoreactors

Application Areas	CR 2200	CR 3200	CR 4200
Routine measurements	●	●	●
Wastewater	●	●	●
Specialized tasks in wastewater	–	●	●
Specialized tasks in wastewater and in laboratories	–	●	●
Number of samples, max.	1 x 12	2 x 12, same program	2 x 12, different programs
7 pre-stored programs	212 °F (100 °C) 60 min, 248 °F (120 °C) with 30 min, 60 min, 120 min, 298.4 °F (148 °C) 120 min, 20 min 302 °F (150 °C) 120 min	212 °F (100 °C) 60 min, 248 °F (120 °C) with 30 min, 60 min, 120 min, 298.4 °F (148 °C) 120 min, 20 min 302 °F (150 °C) 120 min	212 °F (100 °C) 60 min, 248 °F (120 °C) with 30 min, 60 min, 120 min, 298.4 °F (148 °C) 120 min, 20 min 302 °F (150 °C) 120 min
Own programs	–	8 freely selectable 77-338 °F (25-170 °C)	8 freely selectable 77-338 °F (25-170 °C)
Control accuracy	±1 °C ±1 digit		
Safety class	I to DIN VDE 0700 part 1/11.90		
Instrument safety	EN 61010, UL 3101, CAN/CSA C22.2-1010; EN 61010-2-010, IEC-CAN/CSA C22.2-1010.2.010		
Dimensions	W: 10.08 in (256 mm); H: 7.28 in (185 mm), open: 11.42 in (290 mm); D: 12.4 in (315 mm)		

## Ordering Information

Model		Order No.
CR 2200	Reactor (230 VAC with Europlug) for COD and other thermal digestions. For up to 12 reaction cuvettes. (Regional power supply available on demand)	1P21-1
CR 3200	Reactor (230 VAC with Europlug) for COD and other thermal digestions. For up to 2x12 reaction cuvettes. (Regional power supply available on demand)	1P22-1
CR 4200	Reactor (230 VAC with Europlug) for COD and other thermal digestions. For up to 2x12 reaction cuvettes in two separately controllable heating blocks. (Regional power supply available on demand)	1P23-1



# Reagents from A – Z

## The right Test for every Application

A wide choice of tests is available for routine analysis in different applications. Depending on the optical system and the wavelength employed, photometer and test set make up a matched system with different specific advantages.

For use with portable photometers, test sets should first of all be straightforward. The low consumption LED optics allow the use of easy-to-use and cost-effective test sets, e.g. powder tests. In the laboratory, instruments with bar code and utmost optical sensitivity suggest the use of high-precision tests with bar code reader, certificate and quality assurance support.

WTW continues to expand our reagent offering. Not only are new tests developed, but the usability of tests with different instruments is continuously expanded. Due to the different photometer optics, one and the same test may yield different measuring ranges in different instruments. LED photometers usually have smaller measuring ranges for the same test.



### Reagents for routine tasks

- Convenient and cost effective
- Precise
- Assured quality by AQA/IQC

### Taking measurements correctly

Every concentration determination is accurate only within the linear absorption range. At the limits of the measuring range you have to expect deviations within the given toler-

ance. Therefore it may be well worth to repeat the measurement using a test set with a better suited measuring range.

Test Types Overview			
Identification:	● = reaction cuvette test	■ = reagent test	TP = powder test TC = cuvette test
Type	Cuvette test	Reagents test	Powder test
<b>Certificate</b>	With certificate (●) for optimum precision Without certificate (TC) for very good precision	With certificate (■) for optimum precision	Without certificate (TP), precise
<b>Test identification</b>	Bar code (●) and/or method selection	Bar code (●) and/or method selection	Method selection, bar code optional (external)
<b>Advantages:</b>	Reaction cuvette with bar code or method selection, 16 mm: Sample adding, inserting, measuring and reading at minimum work, QA support for assured results	Large measuring range, using 10, 20 and 50 mm rectangular cuvettes for determination also of trace concentrations. QA support for assured results	Compact, straight forward procedure few paraphernalia
<b>Application area:</b>	Laboratory, infrequent work or very large sample throughput	Laboratory, low concentrations, cost-effective routine work with large sample throughput	Mobile measurements, screening and monitoring tasks



Reagents									photoLab®				
Model	Measuring Range (Specification max.)	Cuvette (mm) <sup>1)</sup> depending on meter	ml	Order No.	No. of tests	CC	SW	S6	S12	Spektral	pHotoFlex®	spectroFlex *	
<b>Acid Capacity up to pH 4.3</b>													
● 01762/1	0.20 - 8.00 mmol/l Ks 4.3 10 - 400 mg/l CaCO <sub>3</sub>	16 16	5 (0.2, 1.0)	252 059	90	-	-	●	●	●	●		
<b>Aluminium Al</b>													
● 00594	0.02 - 0.50 mg/l Al	16	6	252 068	25	-	✓	-	●	●	-	●	
■ 14825	0.020 - 1.20 mg/l Al	10, 20, 50, 28	5	250 425	300	✓	✓	-	●	●	●	●	
TP Al-1 TP	0.00 - 0.25 mg/l	28	20	251 400	100	-	-	-	-	-	●	-	
<b>Ammonia NH<sub>3</sub> (subject to pH value)</b>													
● 14544	0.5 - 16.0 mg/l NH <sub>4</sub> -N 0.7 - 20.6 mg/l NH <sub>4</sub>	16	0.5	250 329	25	-	-	-	-	-	●	-	
■ 14752/1	0.02 - 1.50 mg/l NH <sub>4</sub> -N 0.03 - 1.93 mg/l NH <sub>4</sub>	16, 28	5	250 426	500	-	-	-	-	-	●	-	
■ 14752/2	0.02 - 1.50 mg/l NH <sub>4</sub> -N 0.03 - 1.93 mg/l NH <sub>4</sub>	16, 28	5	252 081	250	-	-	-	-	-	●	-	
<b>Ammonium NH<sub>4</sub></b>													
● 14739	0.010 - 2.000 mg/l NH <sub>4</sub> -N 0.01 - 2.60 mg/l NH <sub>4</sub> <sup>+</sup>	16	5	250 495	25	✓	-	●	●	●	-	●	
● A6/25	0.20 - 8.00 mg/l NH <sub>4</sub> -N 0.26 - 10.3 mg/l NH <sub>4</sub> <sup>+</sup>	16	1	252 072	25	✓	✓	●	●	●	●	●	
● 14544	0.5 - 16.0 mg/l NH <sub>4</sub> -N 0.6 - 20.6 mg/l NH <sub>4</sub> <sup>+</sup>	16	0.5	250 329	25	✓	✓	●	●	●	●	●	
● 14559	4.0 - 80.0 mg/l NH <sub>4</sub> -N 5.2 - 103.0 mg/l NH <sub>4</sub> <sup>+</sup>	16	0.1	250 424	25	✓	✓	●	●	●	-	●	
■ 14752/1	0.010 - 3.00 mg/l NH <sub>4</sub> -N 0.013 - 3.86 mg/l NH <sub>4</sub> <sup>+</sup>	10, 20, 50, 16, 28	5	250 426	500	✓	✓	-	●	●	●	●	
■ 14752/2	0.010 - 3.00 mg/l NH <sub>4</sub> -N 0.013 - 3.86 mg/l NH <sub>4</sub> <sup>+</sup>	10, 20, 50, 16, 28	5	252 081	250	✓	✓	-	●	●	●	●	
■ 00683	2.0 - 150 mg/l NH <sub>4</sub> -N 2.6 - 193 mg/l NH <sub>4</sub> <sup>+</sup>	10	0.1, 0.2	252 027	100	✓	✓	-	●	●	-	●	
TP NH <sub>4</sub> -1 TP	0.00 - 0.50 mg/l NH <sub>4</sub> -N 0.00 - 0.64 mg/l NH <sub>4</sub> <sup>+</sup>	28	10	251 408	200	-	-	-	-	-	●	-	
TC NH <sub>4</sub> -2 TC (LR)	0.00 - 2.50 mg/l NH <sub>4</sub> -N 0.00 - 3.20 mg/l NH <sub>4</sub> <sup>+</sup>	16	2	251 997	50	-	-	-	-	-	●	-	
TC NH <sub>4</sub> -3 TC (HR)	0 - 50 mg/l NH <sub>4</sub> -N 0 - 64 mg/l NH <sub>4</sub> <sup>+</sup>	16	0.1	251 998	50	-	-	-	-	-	●	-	
<b>Antimony:</b> Please ask for application leaflets													
<b>AOX</b>													
● 00675	0.05 - 2.50 mg/l AOX	16		252 023	25	-	-	●	●	●	-		
<b>Arsenic</b>													
■ 01747	0.001 - 0.100 mg/l As	10, 20	350	252 063	30	-	-	-	●	●	●		
also AS absorption tube required:				252 066									
<b>Ascorbic acid:</b> Please ask for application leaflets													
<b>BOD Biochemical oxygen demand O<sub>2</sub></b>													
● 00687	0.5 - 3000 mg/l BOD	16	-	252 028	50	-	✓	●	●	●	-		
● = Reaction cuvettes tests;    TC = Cuvette Test;    CC = CombiCheck test;    ml = Sample volume (photoLab®);    1) Ø 16, 28 ■ = Reagent tests;    TP = Powder Pillows;    SW = Sea Water;    * = is constantly being completed    □ 10,20,50													

Parameter  
pH  
ORP  
ISE  
Oxygen (D.O.)  
Conductivity  
Multi-parameter  
BOD/Respiration  
Photometers  
Turbidity  
Colony Counter  
Software/Printers

Reagents									photoLab®				
Model	Measuring Range (Specification max.)	Cuvette (mm) <sup>1)</sup> depending on meter	ml	Order No.	No. of tests	CC	SW	S6	S12	Spektral	pHotoFlex®	spectroFlex*	
<b>Boron B</b>													
■ 14839	0.050 - 0.800 mg/l B	10, 20	5	250 427	60	-	-	-	●	●	-		
● 00826	0.05 - 2.00 mg/l B	16	4	252 041	25	-	✓	-	●	●	-		
<b>Bromine Br<sub>2</sub></b>													
■ 00605	0.020 - 10 mg/l Br <sub>2</sub>	10, 20, 50	10	252 014	200	-	-	-	●	●	-	●	
<b>Cadmium Cd</b>													
● 14834	0.025 - 1.000 mg/l Cd	16	5	250 314	25	✓	-	●	●	●	●	●	
■ 01745	0.002 - 0.500 mg/l Cd	10, 20, 50	10	252 051	55	-	-	●	●	●	-	●	
<b>Calcium Ca</b>													
■ 14815	5 - 160 mg/l Ca	10, 20, 16, 28	0.1	250 428	100	-	✓	-	●	●	●		
● 00858	10 - 250 mg/l Ca	16	1	252 047	25	-	-	●	●	●	-		
<b>Chlorine Cl<sub>2</sub></b> (f = free, t = total)													
● 00595	0.03 - 6.00 Cl <sub>2</sub> , f	16	5	250 419	200	-	-	●	●	●	●	●	
● 00597	0.03 - 6.00 Cl <sub>2</sub> , f+t	16	5	250 420	200	-	-	●	●	●	●	●	
■ 00598/1	0.010 - 6.00 Cl <sub>2</sub> , f	10, 20, 50	10	252 010	1200	-	-	-	●	●	-	●	
■ 00598/2	0.010 - 6.00 Cl <sub>2</sub> , f	10, 20, 50	10	252 011	200	-	-	-	●	●	-	●	
■ 00599	0.010 - 6.00 Cl <sub>2</sub> , f+t	10, 20, 50	10	252 012	200	-	-	-	●	●	-	●	
■ 00602/1	0.010 - 6.00 Cl <sub>2</sub> , t	10, 20, 50	10	252 013	200	-	-	-	●	●	-	●	
■ 00602/2	0.010 - 6.00 Cl <sub>2</sub> , t	10, 20, 50	10	252 055	1200	-	-	-	●	●	-	●	
TP CI-1 TP	0.00 - 2.00 mg/l Cl <sub>2</sub> , f	28	10	251 401	100	-	-	-	-	-	●	-	
TP CI-2 TP	0.00 - 5.00 mg/l Cl <sub>2</sub> , f	28	25	251 402	100	-	-	-	-	-	●	-	
TP CI-3 TP	0.00 - 2.00 mg/l Cl <sub>2</sub> , t	28	25	251 414	100	-	-	-	-	-	●	-	
<b>Chlorine Liquid test kit (free and total chlorine) Cl<sub>2</sub></b>													
● / ■	0.010 - 6.00 Cl <sub>2</sub>	16, 50	10			-	-	●	●	●	-		
	00086 Chlorine reagent Cl2-1			252 077	200								
	00087 Chlorine reagent Cl2-2			252 078	400								
	00088 Chlorine reagent Cl2-3			252 079	600								
	00089 Accessories Cl2 (round cells etc.)			252 080	25								
<b>Chloride Cl</b>													
● 14730	5 - 125 mg/l Cl	16	1	250 353	25	✓	✓	●	●	●	●	●	
■ 14897/1	2.5 - 250 mg/l Cl	10, 16	1, 5	250 491	100	✓	✓	-	●	●	●	●	
■ 14897/2	2.5 - 250 mg/l Cl	10, 16	1, 5	252 082	175	✓	✓	-	●	●	●	●	
<b>Chlorine dioxide ClO<sub>2</sub></b>													
■ 00608	0.020 - 10.00 mg/l ClO <sub>2</sub>	10, 20, 50, 16, 28	10	252 017	150	-	-	-	●	●	●	●	
<b>Chromate (chromium VI and total chromium) Cr</b>													
● 14552	0.05 - 2.00 mg/l Cr	16	10	250 341	25	-	✓	●	●	●	●	●	
■ 14758	0.01 - 3.00 mg/l Cr	10, 20, 50	5	250 433	250	-	✓	-	●	●	-	●	
<b>Chromium plating bath CrO<sub>3</sub>:</b>													
See reagent-free tests													
● = Reaction cuvettes tests;    TC = Cuvette Test;    CC = CombiCheck test;    ml = Sample volume (photoLab®);    1) Ø 16, 28 ■ = Reagent tests;    TP = Powder Pillows;    SW = Sea Water;    * = is constantly being completed    □ 10,20,50													

Reagents									photoLab®				
Model	Measuring Range (Specification max.)	Cuvette (mm) <sup>1)</sup> depending on meter	ml	Order No.	No. of tests	CC	SW	S6	S12	Spektral	pHotoFlex®	spectroFlex *	
<b>COD Chemical oxygen demand O<sub>2</sub></b>													
● 14560	4.0 - 40.0 mg/l COD (148 °C, 2 h)	16	3	250 303	25	✓	-	●	●	●	-	●	
● C3/25	10 - 150 mg/l COD (148 °C, 2 h)	16	3	252 070	25	✓	-	●	●	●	●	●	
● 14895	15 - 300 mg/l COD (148 °C, 2 h)	16	2	250 359	25	✓	-	●	●	●	-	●	
● 14690	50 - 500 mg/l COD (148 °C, 2 h)	16	2	250 304	25	✓	-	●	●	●	-	●	
● C4/25	25 - 1500 mg/l COD (148 °C, 2 h)	16	3	252 071	25	✓	-	●	●	●	●	●	
● 14691	300 - 3500 mg/l COD (148 °C, 2 h)	16	2	250 351	25	✓	-	●	●	●	-	●	
● 14555	500 - 10000 mg/l COD (148 °C, 2 h)	16	1	250 309	25	✓	-	●	●	●	-	●	
TC COD1 TC (LR)	0 - 150 mg/l COD (148 °C, 2 h)	16	2	251 990	25	-	-	-	-	-	●	-	
TC COD2 TC (MR)	0 - 1500 mg/l COD (148 °C, 2 h)	16	2	251 991	25	-	-	-	-	-	●	-	
TC COD3 TC (HR)	0 - 15000 mg/l COD (148 °C, 2 h)	16	0,2	251 992	25	-	-	-	-	-	●	-	
<b>COD Chemical oxygen demand (HG free) O<sub>2</sub></b>													
● 09772	10 - 150 mg/l COD (148 °C, 2h)	16	2	250 301	25	✓	-	●	●	●	●	●	
● 09773	100 - 1500 mg/l COD (148 °C, 2h)	16	2	250 306	25	✓	-	●	●	●	●	●	
<b>Copper Cu</b>													
● 14553	0.05 - 8.00 mg/l Cu	16	5	250 408	25	-	✓	●	●	●	●	●	
■ 14767	0.02 - 6.00 mg/l Cu	10, 20, 50, 16, 28	10	250 441	250	-	✓	-	●	●	●	●	
TP Cu-1 TP	0.00 - 5.00 mg/l Cu	28	10	251 403	100	-	-	-	-	-	●	-	
<b>Copper plating bath Cu:</b> See reagent-free tests													
<b>Cyanide (free and easy liberatable cyanide) CN</b>													
● 14561	0.010 - 0.500 mg/l CN	16	5	250 344	25	-	-	●	●	●	●	●	
■ 09701	0.002 - 0.500 mg/l CN	10, 20, 50	5, 10	250 492	100	-	-	-	●	●	-	●	
<b>Detergents:</b> see Surfactants: anionic, cationic, nonionic													
<b>Fluoride F</b>													
● 14557	0.10 - 1.50 mg/l F	16	5	250 365	25	-	✓	-	●	●	●	●	
■ 14598/1	0.10 - 20.0 mg/l F	10	5 or 0.5	252 048	100	-	-	-	●	●	-	●	
■ 14598/2	0.10 - 20.0 mg/l F	10	5 or 0.5	252 083	250	-	-	-	●	●	-	●	
<b>Formaldehyde HCHO</b>													
● 14500	0.10 - 8.00 mg/l HCHO	16	2	250 406	25	-	-	●	●	●	-	●	
■ 14678	0.02 - 8.00 mg/l HCHO	10, 20, 50	3	250 331	100	-	-	-	●	●	-	●	
<b>Gold Au</b>													
■ 14821	0.5 - 12.0 mg/l Au	10, 16	2	250 436	80	✓	✓	-	●	●	●	●	
<b>Halogens (total):</b> see Cl <sub>2</sub> , Br <sub>2</sub> , I <sub>2</sub> , ClO <sub>2</sub> , O <sub>3</sub>													
<b>Hazen:</b> See reagent-free tests: Coloration													
<b>Heavy metals:</b> see lead, cadmium, chromium													
● = Reaction cuvettes tests;    TC = Cuvette Test;    CC = CombiCheck test;    ml = Sample volume (photoLab®);    1) Ø 16, 28 ■ = Reagent tests;    TP = Powder Pillows;    SW = Sea Water;    * = is constantly being completed    □ 10,20,50													

Parameter  
pH  
ORP  
ISE  
Oxygen (D.O.)  
Conductivity  
Multi-parameter  
BOD/Respiration  
Photometers  
Turbidity  
Colony Counter  
Software/Printers

Reagents									photoLab®			pHotoFlex®		spectroFlex*
Model	Measuring Range (Specification max.)	Cuvette (mm) <sup>1)</sup> depending on meter	ml	Order No.	No. of tests	CC	SW	S6	S12	Spektral	pHotoFlex®	spektral	spectroFlex*	
<b>Hydrazine N<sub>2</sub>H<sub>4</sub></b>														
■ 09711	0.005 - 2.00 mg/l N <sub>2</sub> H <sub>4</sub>	10, 20, 50	5	250 493	100	-	-	-	●	●	-	-	-	
<b>Hydrogen peroxide H<sub>2</sub>O<sub>2</sub></b>														
● 14731	2.0 - 20.0 mg/l H <sub>2</sub> O <sub>2</sub>	16	10	250 402	25	-	✓	-	●	●	-	-	-	
■ 18789	0.015 - 6.00 mg/l H <sub>2</sub> O <sub>2</sub>	10, 20	8	252 067	100	-	-	-	●	●	-	-	-	
<b>Iodine I<sub>2</sub></b>														
■ 00606	0.050 - 10.00 mg/l I <sub>2</sub>	10, 20, 50	10	252 015	200	-	-	-	●	●	-	-	●	
<b>Iodine number:</b>														
See reagent-free tests: Coloration														
<b>Iron Fe</b>														
● 14549	0.05 - 4.00 mg/l Fe	16	5	250 349	25	✓	✓	●	●	●	●	●	●	
● 14896	1.0 - 50.0 mg/l Fe	16	1	250 361	25	-	-	●	●	●	-	-	-	
■ 14761/1	0.005 - 5.00 mg/l Fe	10, 20, 50, 16, 28	5	250 435	1000	✓	✓	-	●	●	●	●	●	
■ 14761/2	0.005 - 5.00 mg/l Fe	10, 20, 50, 16, 28	5	250 439	250	✓	✓	-	●	●	●	●	●	
■ 00796	0.010 - 5.00 mg/l Fe	10, 20, 50	8	252 042	150	✓	✓	-	●	●	-	-	●	
TP Fe-1 TP	0.00 - 1.80 mg/l Fe	16, 28	10	251 404	100	-	-	-	-	-	●	-	-	
TP Fe-2 TP	0.00 - 3.00 mg/l Fe	16, 28	10	251 405	100	-	-	-	-	-	●	-	-	
<b>Lead Pb</b>														
● 14833	0.10 - 5.00 mg/l Pb	16	5	250 313	25	✓	-	●	●	●	-	-	●	
■ 09717	0.010 - 5.00 mg/l Pb	10, 50, 16, 28	8	252 034	50	✓	-	-	●	●	●	●	●	
<b>Magnesium Mg</b>														
● 00815	5.0 - 75.0 mg/l Mg	16	1	252 043	25	-	✓	●	●	●	●	-	-	
<b>Manganese Mn</b>														
■ 01739	0.005 - 2.000 mg/l Mn	10, 20, 50	8	252 056	250	-	-	-	●	●	-	-	●	
■ 14770/1	0.01 - 10.0 mg/l Mn	10, 20, 50, 16, 28	5	250 442	500	✓	✓	-	●	●	●	●	●	
■ 14770/2	0.01 - 10.0 mg/l Mn	10, 20, 50, 16, 28	5	252 084	250	✓	✓	-	●	●	●	●	●	
● 00816	0.10 - 5.00 mg/l Mn	16	7	252 035	25	✓	-	●	●	●	●	●	●	
TP Mn-1 TP	0.0 - 20.0 mg/l Mn	16, 28	10	251 406	100	-	-	-	-	-	●	-	-	
<b>Molybdenum Mo</b>														
● 00860	0.02 - 1.00 mg/l Mo	16	10	252 040	25	-	-	-	●	●	-	-	-	
TP Mo-1 TP	0.0 - 35.0 mg/l Mo	16, 28	10	251 407	100	-	-	-	-	-	●	-	-	
<b>Monochloramine</b>														
■ 01632	0.05 - 10.0 mg/l Cl <sub>2</sub>	10, 20, 50		252 057	150	-	-	-	●	●	-	-	-	
<b>Nickel Ni</b>														
● 14554	0.10 - 6.00 mg/l Ni	16	5	250 409	25	✓	-	●	●	●	-	-	●	
■ 14785	0.02 - 5.00 mg/l Ni	10, 20, 50	5	250 443	250	✓	-	-	●	●	-	-	●	
<b>Nickel plating bath:</b>														
See reagent-free tests														
<b>Nitrogen (total):</b>														
see Total Nitrogen N <sub>Total</sub>														

● = Reaction cuvettes tests; TC = Cuvette Test; CC = CombiCheck test; ml = Sample volume (photoLab®); 1) Ø 16, 28  
 ■ = Reagent tests; TP = Powder Pillows; SW = Sea Water; \* = is constantly being completed □ 10,20,50



Reagents							CC	SW	photoLab®				
Model	Measuring Range (Specification max.)	Cuvette (mm) <sup>1)</sup> depending on meter	ml	Order No.	No. of tests	S6			S12	Spektral	pHotoFlex®	spectroFlex *	
<b>Nitrate NO<sub>3</sub></b>													
● 14556	0.10 - 3.00 mg/l NO <sub>3</sub> -N 0.44 - 13.30 mg/l NO <sub>3</sub>	16	2	250 411	25	✓	✓	-	●	●	●	●	
● N2/25	0.5 - 25.0 mg/l NO <sub>3</sub> -N 2.2 - 110.7 mg/l NO <sub>3</sub>	16	1	252 073	25	✓	-	●	●	●	-	●	
● 14542	0.5 - 18.0 mg/l NO <sub>3</sub> -N 2.2 - 79.7 mg/l NO <sub>3</sub>	16	1.5	250 410	25	✓	-	●	●	●	●	●	
● 14764	1.0 - 50.0 mg/l NO <sub>3</sub> -N 4 - 221 mg/l NO <sub>3</sub>	16	0.5	250 347	25	✓	-	●	●	●	-	●	
● 00614	23 - 225 mg/l NO <sub>3</sub> -N 102 - 996 mg/l NO <sub>3</sub>	16	0.1	252 019	25	-	-	●	●	●	-		
■ 14942	0.2 - 17.0 mg/l NO <sub>3</sub> -N 0.9 - 75.3 mg/l NO <sub>3</sub>	10, 20, 50, 16	1	250 422	50	✓	✓	-	●	●	●		
■ 14773	0.2 - 20.0 mg/l NO <sub>3</sub> -N 0.9 - 88.5 mg/l NO <sub>3</sub>	10, 20	1.5, 3	250 444	100	✓	-	-	●	●	-	●	
■ 09713/1	0.1 - 25.0 mg/l NO <sub>3</sub> -N 0.45 - 110.7 mg/l NO <sub>3</sub>	10, 20, 50	0.5	250 421	90	✓	-	-	●	●	-	●	
■ 09713/2	0.1 - 25.0 mg/l NO <sub>3</sub> -N 0.45 - 110.7 mg/l NO <sub>3</sub>	10, 20, 50	0.5	252 085	250	✓	-	-	●	●	-	●	
TC NO3-1 TC	0 - 30.0 mg/l NO <sub>3</sub> -N 0.0 - 133.0 mg/l NO <sub>3</sub>	16	2	251 993	50	-	-	-	-	-	●	-	
<b>Nitrite NO<sub>2</sub></b>													
● N5/25	0.010 - 0.700 mg/l NO <sub>2</sub> -N 0.03 - 2.30 mg/l NO <sub>2</sub>	16	5	252 074	25	-	✓	●	●	●	●	●	
■ 14776/1	0.005 - 1.000 mg/l NO <sub>2</sub> -N 0.016 - 3.29 mg/l NO <sub>2</sub>	10, 20, 50, 16, 28	5	250 445	1000	-	✓	-	●	●	●	●	
■ 14776/2	0.005 - 1.000 mg/l NO <sub>2</sub> -N 0.016 - 3.29 mg/l NO <sub>2</sub>	10, 20, 50, 16, 28	5	250 440	335	-	✓	-	●	●	●	●	
■ 00609	1.0 - 90.0 mg/l NO <sub>2</sub> -N 3.3 - 295.2 mg/l NO <sub>2</sub>	16	8	252 069	25	-	-	●	●	●	-		
TP NO <sub>2</sub> -1 TP	0.00 - 0.33 mg/l NO <sub>2</sub> -N 0.00 - 1.08 mg/l NO <sub>2</sub>	16, 28	10	251 409	100	-	-	-	-	-	●	-	
TC NO <sub>2</sub> -2 TC	0.03 - 0.60 mg/l NO <sub>2</sub> -N (LR) 0.10 - 2.00 mg/l NO <sub>2</sub> (LR) 0.30 - 3.00 mg/l NO <sub>2</sub> -N (HR) 0.99 - 9.90 mg/l NO <sub>2</sub>	16	2	251 994	48	-	-	-	-	-	●	-	
		16	0,5										
<b>Organic Acids (volatile)</b>													
● 01763	50 - 3000 mg/l	16		252 060	100	-	-	●	●	●	-		
<b>Oxygen O<sub>2</sub></b>													
● 14694	0.5 - 12.0 mg/l O <sub>2</sub>	16	-	250 403	25	-	-	●	●	●	-		
<b>Ozone O<sub>3</sub></b>													
■ 00607/1	0.010 - 4.00 mg/l O <sub>3</sub>	10, 20, 50, 16, 28	10	252 016	200	-	-	-	●	●	●	●	
■ 00607/2	0.010 - 4.00 mg/l O <sub>3</sub>	10, 20, 50, 16, 28	10	252 054	1200	-	-	-	●	●	●	●	
■ 14732	replaced by ClO <sub>2</sub> 00608 and ozone 00607												
<b>pH</b>													
● 01744	pH 6.4 - 8.6	16	10	252 050	280	-	✓	●	●	●	-		
<b>Phenol C<sub>6</sub>H<sub>5</sub>OH</b>													
■ 00856	0.002 - 0.100 mg/l C <sub>6</sub> H <sub>5</sub> OH 0.025 - 5.000 mg/l C <sub>6</sub> H <sub>5</sub> OH	20 10, 20, 50	200 10	252 058	50 250	-	✓	-	●	●	-		
● 14551	0.10 - 2.50 mg/l C <sub>6</sub> H <sub>5</sub> OH	16	10	250 412	25	-	✓	-	●	●	-		
● = Reaction cuvettes tests;    TC = Cuvette Test;    CC = CombiCheck test;    ml = Sample volume (photoLab®);    1) Ø 16, 28 ■ = Reagent tests;    TP = Powder Pillows;    SW = Sea Water;    * = is constantly being completed    □ 10,20,50													

Parameter  
pH  
ORP  
ISE  
Oxygen (D.O.)  
Conductivity  
Multi-parameter  
BOD/Respiration  
Photometers  
Turbidity  
Colony Counter  
Software/Printers

Reagents									photoLab®			pHotoFlex®	spectroFlex*
Model	Measuring Range (Specification max.)	Cuvette (mm) <sup>1)</sup> depending on meter	ml	Order No.	No. of tests	CC	SW	S6	S12	Spektral			
<b>Phosphate PO<sub>4</sub></b>													
● P6/25	0.05 – 5.00 mg/l PO <sub>4</sub> -P 0.05 – 5.0 mg/l P <sub>Total</sub> 0.2 - 15.3 mg/l PO <sub>4</sub>	16	5	252 075	25	✓	✓	●	●	●	●	●	
● 14543	0.05 - 5.00 mg/l PO <sub>4</sub> -P 0.05 - 5.00 mg/l P <sub>Total</sub> 0.2 - 15.3 mg/l PO <sub>4</sub>	16	5	250 324	25	✓	✓	●	●	●	●	●	
● P7/25	0.5 - 25.0 mg/l PO <sub>4</sub> -P 0.5 - 25.0 mg/l P <sub>Total</sub> 1.5 - 76.7 mg/l PO <sub>4</sub>	16	1	252 076	25	✓	✓	●	●	●	●	●	
● 14546	0.5 - 25.0 mg/l PO <sub>4</sub> -P 1.5 - 76.7 mg/l PO <sub>4</sub>	16	5	250 413	25	✓	✓	●	●	●	●	●	
● 14729	<i>Will be replaced in Q1/2008 by P7/25</i>												
● 00616	3.0 - 100.0 mg/l PO <sub>4</sub> -P 10.0 - 307.0 mg/l PO <sub>4</sub>	16, 28	0.2	252 021	25	-	✓	●	●	●	●	●	
■ 14848/1	0.01 - 5.00 mg/l PO <sub>4</sub> -P 0.03 - 15.3 mg/l PO <sub>4</sub>	10, 20, 50, 16, 28	5	250 446	420	✓	✓	-	●	●	●	●	
■ 14848/2	0.01 - 5.00 mg/l PO <sub>4</sub> -P 0.03 - 15.3 mg/l PO <sub>4</sub>	10, 20, 50, 16, 28	5	252 086	220	✓	✓	-	●	●	●	●	
■ 14842	0.5 - 30.0 mg/l PO <sub>4</sub> -P 1.5 - 92.0 mg/l PO <sub>4</sub>	10, 20	5	250 447	400	-	✓	-	●	●	-	-	
■ 00798	1.0 - 100.0 mg/l PO <sub>4</sub> -P 3.0 - 307.0 mg/l PO <sub>4</sub>	10, 16	8	252 045	100	-	✓	-	●	●	●	●	
TP PO <sub>4</sub> -1 TP	0.00 - 0.80 mg/l PO <sub>4</sub> -P 0.00 - 2.45 mg/l PO <sub>4</sub>	28	10	251 410	100	-	-	-	-	-	●	-	
TC PO <sub>4</sub> -2 TC	0.00 - 1.60 mg/l PO <sub>4</sub> -P 0.00 - 4.91 mg/l PO <sub>4</sub>	16	5	251 989	50	-	-	-	-	-	●	-	
TC PO <sub>4</sub> -3 TC	0.00 - 1.10 mg/l PO <sub>4</sub> -P 0.00 - 1.10 mg/l P <sub>Total</sub> (digestion) 0.00 - 3.37 mg/l PO <sub>4</sub>	16	5	251 988	50	-	-	-	-	-	●	-	
<b>Phosphate (total):</b> see Phosphate PO <sub>4</sub>													
<b>Potassium K</b>													
● 14562	5.0 - 50.0 mg/l K	16	2	250 407	25	-	✓	●	●	●	●	●	
● 00615	30 - 300 mg/l K	16	0.5	252 020	25	-	✓	●	●	●	●	●	
<b>SAC</b> See reagent-free tests													
<b>Silicate/Silicic acid Si</b>													
■ 14794	0.005 - 5.00 mg/l Si 0,11 - 10,70 mg/l SiO <sub>2</sub>	10, 20, 50, 16, 28	5	250 438	300	-	✓	-	●	●	●	●	
■ 00857	0.5 - 500 mg/l Si	10, 16, 28	4/0.5	252 046	100	-	-	-	●	●	●	●	
TP Si-1 TP (LR)	0.00 - 0.75 mg/l Si 0.00 - 1.60 SiO <sub>2</sub>	16, 28	10	251 411	100	-	-	-	-	-	●	-	
TP Si-2 TP (HR)	0.0 - 46.7 mg/l Si 0.0 - 100.0 mg/l SiO <sub>2</sub>	16, 28	10	251 412	100	-	-	-	-	-	●	-	
<b>Silver Ag</b>													
■ 14831	0.25 - 3.00 mg/l Ag (total-Ag: 100 °C or 120 °C, 1 h) Digestion reagents are contained in the test set	10, 20	10	250 448	100	-	-	-	●	●	-	-	
<b>Sodium Na</b>													
● 00885	10 - 300 mg/l Na	16	0.5	252 044	25	-	-	●	●	●	●	●	
● = Reaction cuvettes tests;    TC = Cuvette Test;    CC = CombiCheck test;    ml = Sample volume (photoLab®);    1) Ø 16, 28 ■ = Reagent tests;    TP = Powder Pillows;    SW = Sea Water;    * = is constantly being completed    □ 10,20,50													

Reagents							CC	SW	photoLab®				
Model	Measuring Range (Specification max.)	Cuvette (mm) <sup>1)</sup> depending on meter	ml	Order No.	No. of tests	S6			S12	Spektral	pHotoFlex®	spectroFlex *	
<b>Sulfate SO<sub>4</sub></b>													
● 14548	5 - 250 mg/l SO <sub>4</sub>	16	5	250 414	25	✓	✓	●	●	●	●		
● 00617	50 - 500 mg/l SO <sub>4</sub>	16	2	252 022	25	✓	✓	●	●	●	●		
● 14564	100 - 1000 mg/l SO <sub>4</sub>	16	1	250 415	25	✓	✓	●	●	●	●		
■ 14791	25 - 300 mg/l SO <sub>4</sub>	10, 20	2.5	250 449	200	✓	-	●	●	●	-		
TP SO <sub>4</sub> -1 TP	0 - 70 mg/l SO <sub>4</sub>	16, 28	10	251 413	100	-	-	-	-	-	● -		
<b>Sulfide/Hydrogensulfide S</b>													
● 14779	0.02 - 1.50 mg/l S	10, 20, 50	5	250 450	220	-	-	-	●	●	-		
<b>Sulfite SO<sub>3</sub></b>													
● 14394	1.0 - 20.0 mg/l SO <sub>3</sub>	16	3	250 416	25	-	-	-	●	●	-		
■ 01746	1.0 - 60.0 mg/l SO <sub>3</sub>	10	2	252 053	150	-	-	-	●	●	-		
<b>Surfactants</b>													
a-Ten (anionic) ●	14697	0.05 - 2.00 mg/l a-Ten	16	250 333	25	-	-	-	●	●	- ●		
c-Ten (cationic) ●	01764	0.05 - 1.50 mg/l CTAB	16	252 062	25	-	-	-	●	●	- ●		
n-Ten (nonionic) ●	01787	0.10 - 7.50 mg/l Triton X-100	16	252 061	25	-	-	-	●	●	- ●		
<b>Tin Sn</b>													
● 14622	0.10 - 2.50 mg/l Sn	16	5	250 401	25	-	✓	-	●	●	-		
<b>TOC Total organic carbon</b>													
● 14878	5.0 - 80.0 mg/l TOC	16	3	252 036	25	-	-	●	●	●	- ●		
● 14879	50 - 800 mg/l TOC	16	3	252 037	25	-	-	●	●	●	- ●		
<b>Total Nitrogen N<sub>Total</sub></b>													
● 14537	0.5 - 15.0 mg/l N <sub>Total</sub> (120 °C, 1 h)	16	10	250 358	25	✓	-	●	●	●	● ●		
● 14763	10 - 150 mg/l N <sub>Total</sub> (120 °C, 1 h)	16	1	250 494	25	✓	-	●	●	●	- ●		
● 00613	0.5 - 15.0 mg/l N <sub>Total</sub> (120 °C, 1 h)	16	10	252 018	25	✓	-	●	●	●	- ●		
TC N <sub>tot</sub> 1 TC (LR)	0 - 25.0 mg/l N <sub>Total</sub> (120°C, 30 min.)	16	2; 2	251 995	50	-	-	-	-	-	● -		
TC N <sub>tot</sub> 2 TC (HR)	5 - 150 mg/l N <sub>Total</sub> (120°C, 30 min.)	16	0.5; 2	251 996	50	-	-	-	-	-	● -		
<b>Total phosphate:</b> see Phosphate PO <sub>4</sub>													
<b>Water hardness, RH Residual hardness</b>													
● 14683	0.075 - 0.750 °d 0.50 - 5.00 mg/l Ca	16	4	250 404	25	-	-	●	●	●	-		
<b>Water hardness, total hardness</b>													
● 00961	0.7 - 30.1 °d, 5 - 215 mg/l Ca	16	1	252 039	25	-	-	●	●	●	● ●		
<b>Zinc Zn</b>													
● 00861	0.025 - 1.000 mg/l Zn	16	2	252 049	25	-	-	●	●	●	● ●		
● 14566	0.20 - 5.00 mg/l Zn	16	0.5	250 417	25	✓	-	●	●	●	● ●		
■ 14832	0.05 - 2.50 mg/l Zn	10	5	250 451	90	-	-	-	●	●	-		
Necessary reagent:	06146	zinc reagent 6		250 452	180	-	-	-	-	-	-		

● = Reaction cuvettes tests;    TC = Cuvette Test;    CC = CombiCheck test;    ml = Sample volume (photoLab®);    1) Ø 16, 28  
 ■ = Reagent tests;    TP = Powder Pillows;    SW = Sea Water;    \* = is constantly being completed    □ 10,20,50

Parameter  
pH  
ORP  
ISE  
Oxygen (D.O.)  
Conductivity  
Multi-parameter  
BOD/Respiration  
Photometers  
Turbidity  
Colony Counter  
Software/Printers

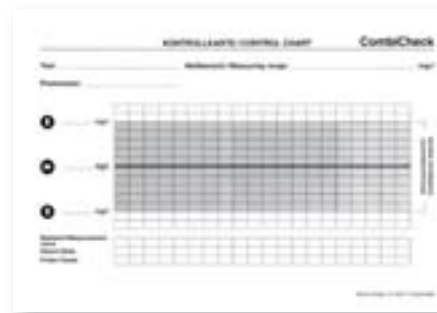
# CombiCheck

**CombiCheck** solutions are ready-to-use multi-parameter standards. Each package contains a standard solution and an addition solution. Both solutions can be used directly **without dilution** for quality assurance.

- The standard solution is used to check the accuracy of the results for the complete system: procedure - analytical method - reagents - photometer.
- The addition solution is used to check sample-dependent influences by measuring the recovery rate and to determine the most suitable sample preparation method.

The maximum number of determinations which can be made with a **CombiCheck** standard solution depends on the test set used. With the addition solution 280 determinations are always possible.

Read also all test kit instructions!



Storage: 35.6 ... 46.4 °F (+2 ... +8 °C)

CombiCheck			
Parameter	Concentration	Suitable for test set model	Max. no. of determinations
14676 CombiCheck 10			250 482
Ammonium	4.00 mg/l NH <sub>4</sub> -N	A5/25	90
		A6/25	90
		14558	90
Chloride	25.0 mg/l Cl	14730	90
COD	80 mg/l CSB	C1/25	45
		C3/25	30
		14540	30
Nitrate	2.5 mg/l NO <sub>3</sub> -N	14556	45
		14773	60
Phosphate	0.80 mg/l PO <sub>4</sub> -P	P4/25	22
		P6/25	18
		14543	18
		14848	9
Sulfate	100 mg/l SO <sub>4</sub>	14548	18
		14791	40
		00617	48
14675 CombiCheck 20			250 483
Ammonium	12.0 mg/l NH <sub>4</sub> -N	14544	180
Chloride	60 mg/l Cl	14730	90
COD	750 mg/l CSB	C2/25	45
		C4/25	30
		14541	30
Nitrate	9.0 mg/l NO <sub>3</sub> -N	N1/25	180
		N2/25	90
		14542	60
		14563	90
		14773	60
		14942	60
Phosphate	8.0 mg/l PO <sub>4</sub> -P	P5/25	180
		P7/25	90
		14729	90
Sulfate	500 mg/l SO <sub>4</sub>	14564	90

CombiCheck			
Parameter	Concentration	Suitable for test set model	Max. no. of determinations
14677 CombiCheck 30			250 484
Cadmium	0.500 mg/l Cd	14834	19
Copper	2.00 mg/l Cu	14553	19
		14767	19
Iron	1.00 mg/l Fe	14549	19
		14761	9
		00796	12
Manganese	1.00 mg/l Mn	14770	9
		00816	13
14692 CombiCheck 40			250 485
Aluminium	0.75 mg/l Al	14825	19
Nickel	2.00 mg/l Ni	14554	19
		14785	19
Lead	2.00 mg/l Pb	14833	19
		09717	11
Zinc	2.00 mg/l Zn	14566	190
14695 CombiCheck 50			250 486
Ammonium	1.00 mg/l NH <sub>4</sub> -N	14739	19
		14752	19
Nitrogen	5.0 mg/l N <sub>ges</sub>	14537	9
COD	20.0 mg/l CSB	00613	9
		14560	32
14696 CombiCheck 60			250 487
COD	250 mg/l CSB	14690	48
		14895	48
Chloride	125 mg/l Cl	14897	96
14689 CombiCheck 70			250 488
Ammonium	50.0 mg/l NH <sub>4</sub> -N	14559	950
		00683	480
COD	5,000 mg/l CSB	14555	95
Nitrogen	50.0 mg/l N <sub>Total</sub>	14763	95
14738 CombiCheck 80			250 489
COD	1,500 mg/l CSB	14691	48
Nitrate	25.0 mg/l NO <sub>3</sub> -N	14764	190
Phosphate	15.0 mg/l PO <sub>4</sub> -P	14729	95
		P7/25	95



# Accessories

## Standard Solutions

Standard solutions which limited stability, to be freshly prepared at regular intervals:

- Free chlorine
- Bound chlorine
- Formaldehyde
- Hydrazine
- Hydrogen peroxide
- Hydrogen sulfide
- Phenol
- Silicon
- Sulfide
- Sulfite
- Anionic surfactants

## Standard Solutions

Parameter	Conc. in mg/l	Amount in ml	Model	Order No.
Aluminium	1000	500	19770	250 460
Ammonium	1000	500	19812	250 461
AOX	20	85 (8-16 Checks)	00680	252 026
Lead	1000	500	19776	250 462
Boron	1000	500	19500	250 463
BOD	210	10 bottles for 10 x 1l	00718	252 030
Cadmium	1000	500	19777	250 464
Calcium	1000	500	19778	250 465
Chloride	1000	500	19897	250 466
Chromium	1000	500	19779	250 467
Chromate	1000	500	19780	250 468
COD 160	100	30	KCSB 100	250 356
COD 1500	400	30	KCSB 400	250 357
Iron	1000	500	19781	250 469
Fluoride	1000	500	19814	250 470
Potassium	1000	500	70230	252 471
Silicic acid (Silicon)	1000	500	70236	252 472
Copper	1000	500	19786	250 473
Manganese	1000	500	19789	250 474
Nickel	1000	500	19792	250 475
Nitrate	1000	500	19811	250 476
Nitrite	1000	500	19899	250 477
Phosphate	1000	500	19898	250 478
Silver	1000	500	19797	250 479
Sulfate	1000	500	19813	250 480
TOC	1000	100	09017	250 499
Zinc	1000	500	19806	250 481

## PhotoCheck

**AQA/IQC: Comprehensive testing aid for optics and measurement linearity!**

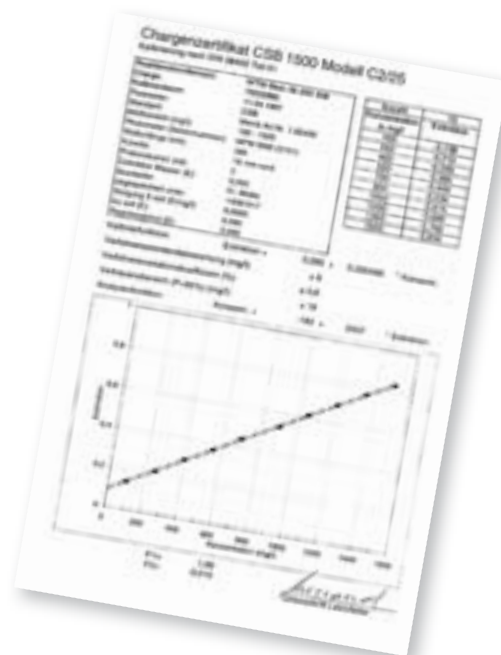
The stable colored solutions are used for checking the filter and the wavelength settings 445 nm/446 nm, 520 nm/525 nm as well as 690 nm. The correctness of the wavelength setting and the linearity of the extinction measurement are checked with 4 solutions per wavelength. The control is fast and comfortable, via a simple, menu-guided function. The traceability of this testing aid to international standards is guaranteed by checking the solutions in a reference photometer monitored with primary standards (NIST standards). These values are documented accordingly.

## PipeCheck

**Testing aid for the right pipetting volume!**

The appropriate test solution is diluted with distilled water using the pipette to be checked and the extinction of the dilute solution is compared with that of a reference solution. Pipettes with a variation in volume of more than  $\pm 2.5\%$  must be regarded as being faulty.

# General Information



- The current **analytical procedure** is included in each package.
- Certificates for test sets ■ and ● can be found on the WTW homepage [www.WTW.com](http://www.WTW.com).
- **Storage:** if no other information is provided then the test set can be stored at **59 to 77 °F (+15 to +25 °C)**.
- WTW recommends regularly checking reagents and photometers, e.g. with **PhotoCheck** and **CombiCheck**.
- Reaction cuvette tests are marked with ● and have only **one** measuring range. The cuvette information is "round", i.e. the outer diameter of the test cuvette is 16 mm. Reaction cuvette tests are pre-prepared rapid tests, with only one measuring range.
- Reagent tests are marked with ■. The measuring range information applies to the total useable measuring range for this method without sample dilution and normally involves changing a (rectangular) cuvette.
- The designation **TC** and **TP** stands for new test sets without charge certificate, that are suited for pHotoFlex®. **TC** are reaction cuvette tests in 0.63 in (16 mm) cuvettes, **TP** are powder tests and are used in 0.63 in and 1.1 in (16 mm and 28 mm) cuvettes according to their measuring range. Measured in round cuvettes with 28 or 16 mm external diameter.
- All reagent tests require, e.g. reaction vessels or RK 14/25 empty cuvettes and rectangular cuvettes
- Round cuvettes are not suitable for repeated use and are not to be used with reagent tests.
- In some tests a second citation form is given for the measuring ranges, e.g. nitrate as nitrate (NO<sub>3</sub>) and as nitrate nitrogen (NO<sub>3</sub>-N). Other possible units and citation forms which can be set are contained in the operating instruction for the instrument.
- Tests which require a **digestion** (e.g. COD) are marked with the **digestion** temperature and time (e.g. 298.4 °F/148 °C, 2 h). Thermoreactors from WTW are equipped with appropriate programs. Crack tests are available for digestion of heavy metal and total nitrogen (*see brochure "Product Details"*).

*The specifications for DIN/ISO/EN/US EPA are mentioned in the brochure "Product Details".*

# Reagent-free Tests

## % transmittance

0 – 100 % T, 10, 20, 50 mm cuvette (self-absorption).

## FAU turbidity

(EN ISO 7027) Determination of turbidity

Turbidity is caused in liquids by the presence of undissolved substances. For undissolved finely dispersed substances the turbidity can be measured by measuring the reduction in the intensity of a beam of light when passed through the liquid, or by measuring the intensity of the scattered radiation. According to EN ISO 7027, all instruments may be used which satisfy the following requirements: Incoming radiation at 860 nm.

The results are given in FAU units (Formazin Attenuation Units) when the radiation passing through is measured.

## Extinction

According to the Lambert-Beer law, the extinction  $E = \epsilon(\lambda) \cdot c \cdot d$  is proportional to the concentration of substances contained in the water. The proportionality constant  $\epsilon(\lambda)$  depends on the wavelength. These constants, and other data required for the determination of the solids in the water are stored in modern photometers as method data. The basic quantity measured is and remains the extinction.

## Coloration

(EN ISO 7887: 1994)

If a layer of several meters of pure water is observed in transmitted light it appears to have a weakly blue coloration. This coloration can alter in the presence of contaminants to form a wide range of colorations. Natural waters are usually colored yellow-brown by contamination with iron or clay particles or humic matter.

(A green coloration can be produced by algae.) The "true" color of water is determined after filtration through a 0.45  $\mu\text{m}$  filter.

Normally most yellow-brown colored waters and the outflows of municipal sewage treatment plants can be measured at 436 nm. The outflows of industrial wastewater treatment plants show no sharp and distinctive extinction maxima. For the investigation of such water it is obligatory to measure at 436 nm (mercury line); the two other measuring wavelengths 525 nm and 620 nm can, depending on the filter used, vary slightly from these wavelengths. For discontinuous measurements the standard permits the use of filter photometers with a spectral bandwidth of < 20 nm for measurements at 436 nm, 525 nm and 620 nm. Thus, for example, instruments with 445 nm and 520 nm interference filters with a bandwidth of 10 nm are also suitable. For comparability with the standard, however, a spectrophotometer is required. The results are presented in  $\text{m}^{-1}$  together with the measuring wavelength, spectral band-

width, water temperature and pH.

In some publications the result is given in DFZ (translucent coloration number); which is identical with the  $\text{m}^{-1}$  result. (DIN ISO 6271: 19988)

Clear liquids, determination of the color number with the platinum-cobalt scale (Hazen color number, APHA color number). Spectrophotometers are mentioned as being suitable for measuring the stock solutions at 430 nm, 455 nm, 480 nm and 510 nm. According to the standard the measurement itself is carried out with a color comparator which allows a visual comparison.

## Chrome-plating bath

Reagent-free measurement of the self-coloration of an electroplating bath. 5 ml of the sample are pipetted into a 100 ml volumetric flask, filled up to the mark with distilled water and well mixed. 4 ml of the diluted sample are pipetted into a 100 ml volumetric flask, filled up to the mark with distilled water and well mixed. 5 ml of the 1:500 dilution are placed in a screw-cap glass and 5 ml 40% sulfuric acid are added. The glass is sealed and the contents well mixed. The solution is filled into a rectangular cuvette for the measurement.

## Nickel-plating bath

Reagent-free measurement of the self-coloration of an electroplating bath. 5 ml of the sample are pipetted into a round cuvette and 5 ml 40% sulfuric acid are added. The cuvette is sealed and the contents mixed. The solution is filled into a rectangular cuvette for the measurement.

## Copper-plating bath

Reagent-free measurement of the self-coloration of an electroplating bath. 25 ml of the sample are pipetted into a 100 ml volumetric flask, filled up to the mark with distilled water and well mixed. 5 ml of the diluted sample are placed in a screw-cap glass and 5 ml 40% sulfuric acid are added. The glass is sealed and the contents well mixed. The solution is filled into a rectangular cuvette for the measurement.

## SAC – Spectral Absorption Coefficient

The spectral absorption coefficient generally known as SAC (unit:1/m) and measured photometrically being the sum of dissolved organic water components. In the drinking water area the SAC is commonly measured at a wavelength of 436 nm, within the wastewater industry at 254 nm. A separation has to be made between clear and turb samples. It has to be considered that the determination as a sum parameter can be applied only usefully when assuming that the composition of the water content is not subject to extreme variations. SAC methods are available as part of the spectroFlex series.

Parameter

pH

ORP

ISE

 Oxygen  
(D.O.)

Conductivity

 Multi-  
parameter

 BOD/  
Respiration

Photometers

Turbidity

 Colony  
Counter

 Software/  
Printers