

Chlorine/Ozone

Principle

Oxidizing agents react with diethyl-p-phenylenediamine (DPD) to form a red dye.

Range of Application

Drinking water, swimming bath water (pools), waste water

Chlorine dioxide and oxidizing agent mixtures

Chlorine dioxide and oxidizing agent mixtures do not always react in the same way with DPD; the reaction depends on the specific conditions. HACH LANGE has prepared an application report on these additional evaluation methods, and this will be supplied free of charge by your local agency on request.

Storage Information

The test reagents are stable at +15 to +25°C up to the expiry date given on the package.

Once a package has been opened it is advisable to keep it in a dark place.

Reagent blank reading

If the chlorine or ozone concentration is less than 0.1 mg/l, we recommend that a reagent blank reading should be taken in order to increase the accuracy of the measurement.

Procedure

Add **one dosage of chlorine powder reagent**. Add distilled water until the level is about **2 cm** (round cuvette) or **1 cm** (50 mm rectangular cuvette) below the mouth of the cuvette. Close the cuvette and invert a few times.
To obtain the reagent blank reading result, follow the procedure used with a sample cuvette (see under "Evaluation").

Calculating of the chlorine and ozone concentrations

Result from water sample (mg/l) - result from reagent blank reading (mg/l)
= chlorine or ozone concentration (mg/l)

Interferences

The ions listed in the table have been individually tested at concentrations up to those indicated with iodide-iodate standard solutions in the 50 mm cuvette. Cumulative effects and the influence of other ions have not been determined by us. There is no interference from:

1000 mg/l: SO_4^{2-} , Na^+ , Cl^-

500 mg/l: Ca^{2+}

250 mg/l: Mg^{2+}

200 mg/l: CO_3^{2-}

100 mg/l: NO_3^-

10 mg/l: Zn^{2+} , SiO_2

5 mg/l: Fe^{3+} , Al^{3+} , F^-

2 mg/l: Cu^{2+}

1 mg/l: Mn^{2+}

The measurement results must be subjected to plausibility checks (dilute and/or spike the water sample).

Determination of total chlorine and free chlorine

The cuvettes must be thoroughly cleaned, as even traces of potassium iodide can interfere with the determination of free chlorine.

The samples must not be pipetted, as this causes losses due to gas emission.

pH/Temperature

The pH of the water sample must lie between pH 4 and pH 8.

The temperature of the water sample and reagents must be between 15 and 25°C.

For special attention

Close chlorine powder reagent with original cap for storage.

CADAS 100 (LPG 185 / ≥ LPG 210)

If this test is not already stored in your instrument please ask your HACH LANGE Agency for programming instructions.

Note

The change indicated by the new edition date and the new colour of the working procedure concerns a **change of factor for all types of photometers**.

Applies to
LASA, LASA 1/plus, LASA 20

Chlorine/Ozone

Edition 09/2013

Free chlorine

Add **one dosage of chlorine powder reagent** to the round cuvette. Then pipette the water sample until the cuvette is filled to about **2 cm** below its mouth. Close the cuvette and invert it for **1 min (don't shake)**. After **30 sec** thoroughly clean the outside of the cuvette and evaluate.

Total chlorine

Immediately after the free chlorine has been measured, introduce **3 drops of potassium iodide solution B** into the cuvette. Close the cuvette and invert a few times. After **2 min** thoroughly clean the outside of the cuvette and evaluate.

Ozone

Add **one dosage of chlorine powder reagent** to the round cuvette. Add **3 drops of potassium iodide solution B** to the cuvette. Then pipette the water sample until the cuvette is filled to about **2 cm** below its mouth. Close the cuvette and invert a few times. After **2 min** thoroughly clean the outside of the cuvette and evaluate.

Applies to LP1W, LP2W,
CADAS 30/30S/50/50S, ISIS 6000/9000,
CADAS 200Basis/Combimodule, LASA 30/100,
Xion 500, CADAS 100 (LPG 185) / (≥ LPG 210),
DR 2800/3800/3900/5000/6000

Chlorine/Ozone

Edition 09/2013

Free chlorine

Add **one dosage of chlorine powder reagent** to the round cuvette or 50 mm rectangular cuvette. Then pipette the water sample until the cuvette is filled to about **2 cm** (round cuvette) or **1 cm** (50 mm rectangular cuvette) below its mouth. Close the cuvette and invert for **1 min (don't shake)**. After **30 sec** thoroughly clean the outside of the cuvette and evaluate.

Total chlorine

Immediately after the free chlorine has been measured, introduce **3 drops of potassium iodide solution B** into the cuvette. Close the cuvette and invert a few times. After **2 min** thoroughly clean the outside of the cuvette and evaluate.

Ozone

Add **one dosage of chlorine powder reagent** to the round cuvette or 50 mm rectangular cuvette. Add **3 drops of potassium iodide solution B** to the cuvette. Then pipette the water sample until the cuvette is filled to about **2 cm** (round cuvette) or **1 cm** (50 mm rectangular cuvette) below its mouth. Close the cuvette and invert a few times. After **2 min** thoroughly clean the outside of the cuvette and evaluate.

LP2W	06/2001
Measurement with round cuvette	
Cl ₂ • F ₁ = 0 • F ₂ = 2.944 • K = 0	
O ₃ • F ₁ = 0 • F ₂ = 1.9 • K = 0	
Measurement with 50 mm rectangular cuvette	
Cl ₂ • F ₁ = 0 • F ₂ = 0.586 • K = 0	
O ₃ • F ₁ = 0 • F ₂ = 0.379 • K = 0	
CADAS 30/30S/50/50S	06/2001
Measurement with round cuvette	
Cl ₂ • λ: 510 nm • Pro.: 1 • F ₁ = 0 • F ₂ = 2.929 • K = 0	
O ₃ • λ: 510 nm • Pro.: 1 • F ₁ = 0 • F ₂ = 1.903 • K = 0	
Measurement with 50 mm rectangular cuvette	
Cl ₂ • λ: 510 nm • Pro.: 1 • F ₁ = 0 • F ₂ = 0.581 • K = 0	
O ₃ • λ: 510 nm • Pro.: 1 • F ₁ = 0 • F ₂ = 0.383 • K = 0	
ISIS 6000/9000	06/2001
Measurement with round cuvette	
Cl ₂ • λ: 545 nm • Pro.: 1 • F ₁ = 0 • F ₂ = 3.076 • K = -0.009	
O ₃ • λ: 545 nm • Pro.: 1 • F ₁ = 0 • F ₂ = 1.999 • K = -0.006	
Measurement with 50 mm rectangular cuvette	
Cl ₂ • λ: 545 nm • Pro.: 1 • F ₁ = 0 • F ₂ = 0.616 • K = -0.004	
O ₃ • λ: 545 nm • Pro.: 1 • F ₁ = 0 • F ₂ = 0.402 • K = -0.002	

CADAS 100 / LPG 185	06/2001
Measurement with round cuvette	
Cl ₂ • λ: 510 nm • F = 2.893	
O ₃ • λ: 510 nm • F = 1.876	
Measurement with 50 mm rectangular cuvette	
Cl ₂ • λ: 510 nm • F = 0.581	
O ₃ • λ: 510 nm • F = 0.374	
CADAS 100 / ≥ LPG 210	06/2001
Measurement with round cuvette	
Cl ₂ • λ: 510 nm • F ₁ = 2.893	
O ₃ • λ: 510 nm • F ₁ = 1.876	
Measurement with 50 mm rectangular cuvette	
Cl ₂ • λ: 510 nm • F ₁ = 0.581	
O ₃ • λ: 510 nm • F ₁ = 0.374	
CADAS 200 Basis / Combimodule	06/2001
Measurement with round cuvette	
Cl ₂ • L1.W1.(M.E1W1) • C1 = (E1-L1)*F1-F2 • W1 = 510 nm • F1 = 2.882 • F2 = 0	
O ₃ • L1.W1.(M.E1W1) • C1 = (E1-L1)*F1-F2 • W1 = 510 nm • F1 = 1.865 • F2 = 0	
Measurement with 50 mm rectangular cuvette	
Cl ₂ • L1.W1.(M.E1W1) • C1 = (E1-L1)*F1-F2 • W1 = 510 nm • F1 = 0.579 • F2 = 0	
O ₃ • L1.W1.(M.E1W1) • C1 = (E1-L1)*F1-F2 • W1 = 510 nm • F1 = 0.377 • F2 = 0.015	

Chlorine/Ozone

Edition 06/2001

Evaluation

1. Check program control number:
 __ : 46 (CADAS 200 Basis, Combimodule)
2. Select »Dr. Lange« mode.
3. Select test number (see below).
4. Control number must be **1**.
5. Insert blank-value cuvette (water sample) and
 press blue key.
6. Insert sample cuvette and press green key.

Measurement with round cuvette

Parameter	Test-No.	Meas. range
Chlorine (Cl ₂)	510	0.1 – 1.5 mg/l
Ozone (O ₃)	510	0.1 – 1.5 mg/l

Measurement with 50 mm rectangular cuvette

Parameter	Test-No.	Meas. range
Chlorine (Cl ₂)	510	0.03 – 0.4 mg/l
Ozone (O ₃)	510	0.03 – 0.4 mg/l

Chlorine/Ozone

Edition 06/2001

Evaluation

1. Select menu "Stored Programs".
2. Select test number (see below) and touch "Start".
3. Insert blank-value cuvette (water sample) and
 touch "Zero".
4. Insert sample cuvette and touch "Read".

Measurement with round cuvette

Parameter	Test-No.	Meas. range
Chlorine (Cl ₂)	510	0.1 – 1.5 mg/l
Ozone (O ₃)	510	0.1 – 1.5 mg/l

Measurement with 50 mm rectangular cuvette

Parameter	Test-No.	Meas. range
Chlorine (Cl ₂)	510	0.03 – 0.4 mg/l
Ozone (O ₃)	510	0.03 – 0.4 mg/l

Chlorine/Ozone

Edition 06/2001

Evaluation

1. Check program control number:
 __ : 46 (ISIS 6000/9000)
2. Select »TEST« mode.
3. Select test number (see below).
4. Control number must be **1**.
5. Insert blank-value cuvette (water sample) and
 press blue key.
6. Insert sample cuvette and press green key.

Measurement with round cuvette

Parameter	Test-No.	Meas. range
Chlorine (Cl ₂)	511	0.05 – 1.5 mg/l
Ozone (O ₃)	511	0.05 – 1.5 mg/l

Measurement with 50 mm rectangular cuvette

Parameter	Test-No.	Meas. range
Chlorine (Cl ₂)	510	0.03 – 0.4 mg/l
Ozone (O ₃)	510	0.03 – 0.4 mg/l

Chlorine/Ozone

Edition 06/2001

Evaluation

1. Check program control number: **__ : 46**
2. Select »TEST« mode.
3. Select test number (see below).
4. Control number must be **1**.
5. Insert blank-value cuvette (water sample) and
 press key below »ZERO«.
6. Insert sample cuvette and press key below »MEAS.«.

Measurement with round cuvette

Parameter	Test-No.	Meas. range
Chlorine (Cl ₂)	511	0.05 – 1.5 mg/l
Ozone (O ₃)	511	0.05 – 1.5 mg/l

Measurement with 50 mm rectangular cuvette

Parameter	Test-No.	Meas. range
Chlorine (Cl ₂)	510	0.03 – 0.4 mg/l
Ozone (O ₃)	510	0.03 – 0.4 mg/l

Chlorine/Ozone

Edition 06/2001

Evaluation

1. Insert program filter with relevant symbol (see below).
2. Select test with relevant key.
3. Check program control number: **__ : 46**
4. Insert sample cuvette.

Measurement with round cuvette

Parameter	Symbol	Meas. range
Chlorine (Cl ₂)	510	0.05 – 1.5 mg/l
Ozone * (O ₃)	510	0.05 – 1.5 mg/l

* **For the ozone determination the displayed result must be multiplied by 0.68.**

Chlorine/Ozone

Edition 06/2001

Evaluation

1. Press "Mode" key.
2. Insert program filter **540 nm**.
3. Select test with "Mode" key.
Control number must be **2*** (see below).
4. Insert sample cuvette.

Measurement with round cuvette

Parameter	Display	Meas. range
Chlorine (Cl ₂)	Chlorine LCW 510 2*	0.05 – 1.5 mg/l
Ozone * (O ₃)	Ozone LCW 510 2*	0.05 – 1.5 mg/l

Chlorine/Ozone

Edition 06/2001

Evaluation

1. Press any key.
2. Check program control number: **__ : 46**
3. Select test with ↑ or ↓ key.
Control number must be **2*** (see below).
4. Insert sample cuvette.

Measurement with round cuvette

Parameter	Display	Meas. range
Chlorine (Cl ₂)	Chlorine LCW 510 2*	0.05 – 1.5 mg/l
Ozone (O ₃)	Ozone LCW 510 2*	0.05 – 1.5 mg/l

Chlorine/Ozone

Edition 06/2001

Evaluation

1. Insert filter **535 nm**.
2. Select »Dr. Lange« mode.
3. Select test number (see below).
4. Control number must be **1**.
5. Insert blank-value cuvette (water sample) and press blue key.
6. Insert sample cuvette and press green key.

Measurement with round cuvette

Parameter	Test-No.	Meas. range
Chlorine (Cl ₂)	510	0.1 – 1.5 mg/l
Ozone (O ₃)	510	0.1 – 1.5 mg/l

Measurement with 50 mm rectangular cuvette

Parameter	Test-No.	Meas. range
Chlorine (Cl ₂)	510	0.03 – 0.4 mg/l
Ozone (O ₃)	510	0.03 – 0.4 mg/l

Chlorine/Ozone

Edition 06/2001

Evaluation

1. Insert filter **510 nm**.
2. Enter factor (see below) and store ↑ .
3. Insert blank-value cuvette (water sample) and press "Null" (zero) key.
4. Insert sample cuvette and press "Ergebnis mit Faktor" (result with factor) key.

Measurement with round cuvette

Parameter	Factor	Meas. range
Chlorine (Cl ₂)	2.944	0.05 – 1.5 mg/l
Ozone (O ₃)	1.9	0.05 – 1.5 mg/l

Measurement with 50 mm rectangular cuvette

Parameter	Factor	Meas. range
Chlorine (Cl ₂)	0.586	0.03 – 0.4 mg/l
Ozone (O ₃)	0.379	0.03 – 0.4 mg/l

Chlorine/Ozone

Edition 06/2001

Evaluation

1. Insert program filter **510 nm**.
2. Press "Tests" key until display (see below) appears.
3. Control number must be **1**.
4. Insert blank-value cuvette (water sample) and press "Null" (zero) key.
5. Insert sample cuvette and press "Ergebnis" (result) key.

Measurement with round cuvette

Parameter	Display	Meas. range
Chlorine (Cl ₂)	Test _ _	0.05 – 1.5 mg/l
Ozone (O ₃)	Test _ _	0.05 – 1.5 mg/l

Measurement with 50 mm rectangular cuvette

Parameter	Display	Meas. range
Chlorine (Cl ₂)	Test _ _	0.03 – 0.4 mg/l
Ozone (O ₃)	Test _ _	0.03 – 0.4 mg/l

Chlorine/Ozone

Edition 06/2001

Evaluation

1. Select »TEST« mode.
2. Select symbol (see below).
3. **CADAS 100 LPG 185:**
Check factors, measuring wavelength in memory »Mem«.
- CADAS 100 ≥ LPG 210:**
Control number must be **1**.
4. Insert blank-value cuvette (water sample) and press "NULL" (zero) key.
5. Insert sample cuvette and press "MESS" (measure) key.

Measurement with round cuvette

Parameter	Symbol	Meas. range
Chlorine (Cl ₂)	510 K	0.1 – 1.5 mg/l
Ozone (O ₃)	510 Z	0.1 – 1.5 mg/l

Measurement with 50 mm rectangular cuvette

Parameter	Symbol	Meas. range
Chlorine (Cl ₂)	510 R	0.03 – 0.4 mg/l
Ozone (O ₃)	510 S	0.03 – 0.4 mg/l