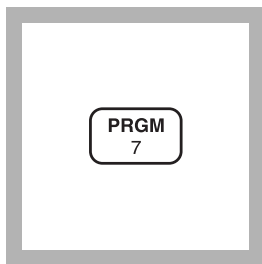


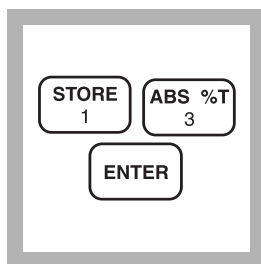
CHROMIUM, HEXAVALENT (0 to 0.60 mg/L Cr⁶⁺) For water and wastewater**1,5-Diphenylcarbohydrazide Method* (Powder Pillows or AccuVac Ampuls)
USEPA accepted for wastewater analyses******Using Powder Pillows**

1. Enter the stored program number for hexavalent chromium (Cr⁶⁺)- powder pillows.

Press: **PRGM**

The display will show:

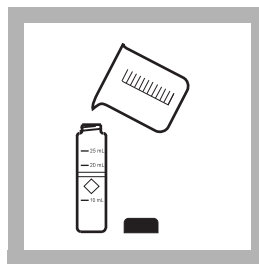
PRGM ?



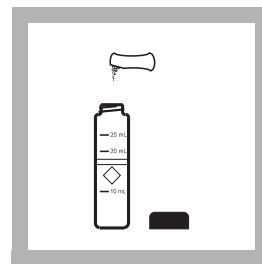
2. Press: **13 ENTER**

The display will show **mg/L, Cr6** and the **ZERO** icon.

*Note: For alternate forms (CrO₄, Cr₂O₇), press the **CONC** key.*

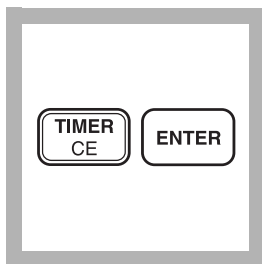


3. Fill a sample cell with 10 mL of sample.



4. Add the contents of one ChromaVer 3 Reagent Powder Pillow to the cell (the prepared sample). Cap the cell and invert several times to mix.

Note: A purple color will form if Cr⁶⁺ is present.



5. Press:

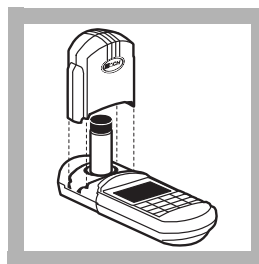
TIMER ENTER

A five-minute reaction period will begin.

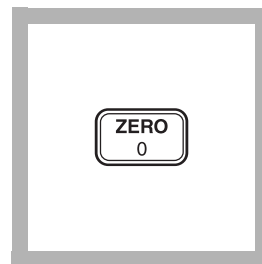


6. Fill another sample cell with 10 mL of sample (the blank).

Note: For turbid samples, add the contents of one Acid Reagent Powder Pillow. This ensures turbidity dissolved by the acid in the ChromaVer 3 Chromium Reagent is also dissolved in the blank.



7. When the timer beeps, place the blank into the cell holder. Tightly cover the sample cell with the instrument cap.



8. Press: **ZERO**

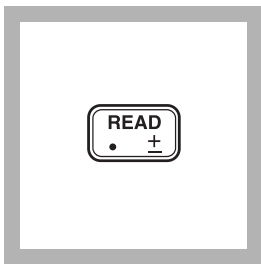
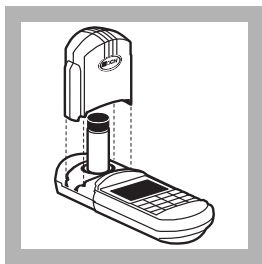
The cursor will move to the right, then the display will show:

0.00 mg/L Cr6

* Adapted from *Standard Methods for the Examination of Water and Wastewater*

** Procedure is equivalent to USGS method I-1230-85 for wastewater.

CHROMIUM, HEXAVALENT, continued



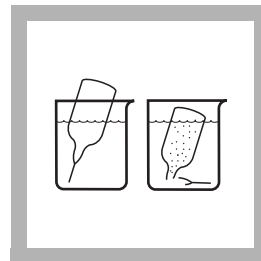
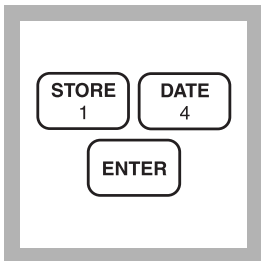
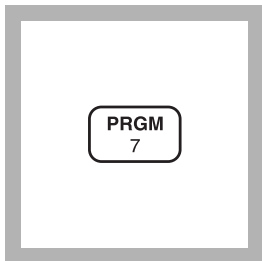
9. Place the prepared sample into the cell holder. Tightly cover the sample cell with the instrument cap.

10. Press: **READ**

The cursor will move to the right, then the result in mg/L hexavalent chromium will be displayed.

Note: Standard Adjust may be performed using a prepared standard (see Standard Adjust in Section 1).

Using Accuvac Ampuls



1. Enter the stored program number for hexavalent chromium (Cr^{6+})- AccuVac Ampuls.

Press: **PRGM**

The display will show:

PRGM ?

2. Press: **14 ENTER**

The display will show **mg/L, Cr6** and the **ZERO** icon.

*Note: For alternate forms (CrO_4 , Cr_2O_7), press the **CONC** key.*

3. Fill a sample cell with at least 10 mL of sample (the blank). Collect at least 40 mL of sample in a 50-mL beaker.

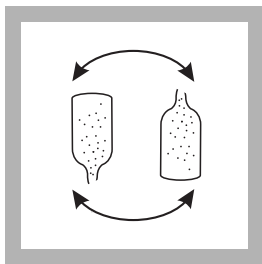
Note: For turbid samples, add the contents of one Acid Reagent Powder Pillow to 10 mL of the blank. This ensures turbidity dissolved by the acid in the ChromaVer 3 Chromium Reagent is also dissolved in the blank.

4. Fill a ChromaVer 3 Reagent AccuVac Ampul (the prepared sample) with sample.

Note: Keep the tip immersed while the ampul fills completely.

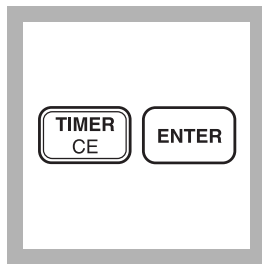
Note: ChromaVer 3 should be white to tan in color. Replace if it is brown or green.

CHROMIUM, HEXAVALENT, continued

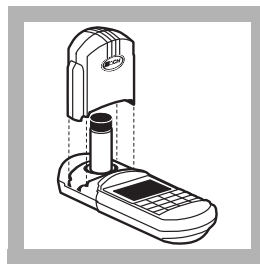


5. Quickly invert the ampul several times to mix. Wipe off any liquid or fingerprints.

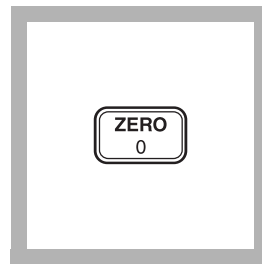
Note: A purple color will form if hexavalent chromium is present.



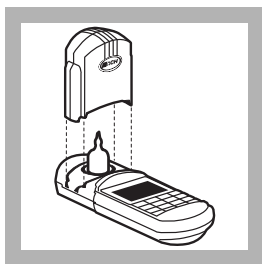
6. Press: **TIMER ENTER**
A five-minute reaction period will begin.



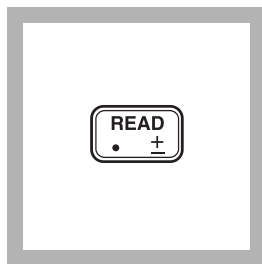
7. When the timer beeps place the blank into the cell holder.



8. Press: **ZERO**
The cursor will move to the right, then the display will show:
0.00 mg/L Cr⁶



9. Place the prepared sample into the cell holder. Tightly cover the sample cell with the instrument cap.



10. Press: **READ**
The cursor will move to the right, then the result in mg/L hexavalent chromium will be displayed.

Note: Standard Adjust may be performed using a prepared standard (see Standard Adjust in Section 1).

Sampling and Storage

Collect samples in a cleaned glass or plastic container. Store at 4 °C (39 °F) up to 24 hours. Samples must be analyzed within 24 hours.

Accuracy Check

Standard Additions Method (powder pillows)

- a) Snap the neck off a Hexavalent Chromium PourRite Standard Ampule, 5 mg/L Cr⁶⁺.

CHROMIUM, HEXAVALENT, continued

- b) Use the TenSette Pipet to add 0.1 mL, 0.2 mL and 0.3 mL of standard to three 10-mL samples, respectively. Swirl to mix.
- c) Analyze each sample as described above. The chromium concentration should increase 0.05 mg/L for each 0.1 mL of standard added.
- d) If these increases do not occur, see *Standard Additions in Section 1* for more information.

Standard Additions Method (AccuVac Ampuls)

- a) Snap the neck off a Hexavalent Chromium Voluette Standard Ampule, 12.5 mg/L Cr⁶⁺.
- b) Use the TenSette Pipet to add 0.1 mL, 0.2 mL and 0.3 mL of standard to three 25-mL samples in beakers. Swirl gently to mix.
- c) Analyze each sample as described above. The chromium concentration should increase 0.05 mg/L for each 0.1 mL of standard added.
- d) If these increases do not occur, see *Standard Additions in Section 1* for more information.

Standard Solution Method

Prepare a 0.50-mg/L Cr⁶⁺ solution by pipetting 10.00 mL of Hexavalent Chromium Standard Solution, 50.0 mg/L Cr⁶⁺, into a 1000-mL volumetric flask and diluting to the mark with deionized water. Invert repeatedly to mix. Prepare this solution daily. Perform the chromium procedure as described above, using this solution in place of the sample.

Method Performance

Precision

In a single laboratory using a standard solution of 0.6 mg/L Cr⁶⁺ and two representative lots of powder pillow reagent with the instrument, a single operator obtained a standard deviation of ± 0.008 mg/L Cr⁶⁺.

In a single laboratory using a standard solution of 0.6 mg/L Cr⁶⁺ and two representative lots of AccuVac Ampuls with the instrument, a single operator obtained a standard deviation of ± 0.005 mg/L Cr⁶⁺.

CHROMIUM, HEXAVALENT, continued

Estimated Detection Limit (EDL)

The EDL for program 13 (powder pillows) and program 14 (AccuVac Ampuls) is 0.01 mg/L Cr⁶⁺. For more information on derivation and use of Hach's estimated detection limit, see *Section 1*.

Interferences

The following substances do not interfere in the test, up to the following concentration:

Substance	Concentration
Mercurous & Mercuric Ions	Interferes slightly
Iron	1 mg/L
Vanadium	1 mg/L. At higher levels vanadium interference can be overcome by waiting ten minutes before reading.

Highly buffered samples or extreme sample pH may exceed the buffering capacity of the reagents and require sample pretreatment; see *pH Interference* in *Section 1*.

Summary of Method

Hexavalent chromium is determined by the 1,5-diphenylcarbohydrazide method using a single dry powder formulation called ChromaVer 3 Chromium Reagent. This reagent contains an acidic buffer combined with 1,5-diphenylcarbohydrazide, which reacts to give a purple color which is proportional to the amount of hexavalent chromium present.

REQUIRED REAGENTS AND APPARATUS (Using Powder Pillows)

Description	Quantity Required		
	Per Test	Unit	Cat. No.
ChromaVer 3 Chromium Reagent Powder Pillows..	1 pillow	100/pkg	12710-99
Sample Cell, 10-20-25 mL, w/ cap	2	6/pkg	24019-06

REQUIRED REAGENTS AND APPARATUS (Using AccuVac Ampuls)

ChromaVer 3 AccuVac Ampuls	1 ampul	25/pkg	25050-25
Beaker, 50 mL	1	each	500-41H

CHROMIUM, HEXAVALENT, continued

OPTIONAL REAGENTS

Description	Unit	Cat. No.
Acid Reagent Powder Pillows	100/pkg.....	2126-99
Chromium, Hexavalent, Standard Solution, 50 mg/L Cr ⁶⁺	100 mL.....	810-42
Chromium, Hexavalent, Standard Solution, Voluette Ampule, 12.5 mg/L Cr ⁶⁺ , 10 mL	16/pkg.....	14256-10
Chromium, Hexavalent, Standard Solution, PourRite Ampule, 5 mg/L Cr ⁶⁺ , 2 mL	20/pkg.....	26056-20
Water, deionized.....	4 L.....	272-56

OPTIONAL APPARATUS

Description	Unit	Cat. No.
AccuVac Snapper Kit.....	each.....	24052-00
Ampule Breaker Kit.....	each.....	21968-00
Flask, volumetric, Class A, 1000 mL	each.....	14574-53
pH Paper, 1 to 11 pH units	5 rolls/pkg	391-33
pH Meter, EC10, portable	each.....	50050-00
Pipet, TenSette, 0.1 to 1.0 mL	each.....	19700-01
Pipet Tips, for 19700-01 TenSette Pipet	50/pkg.....	21856-96
Pipet Tips, for 19700-01 TenSette Pipet	50/pkg.....	21856-96
Pipet, volumetric, 5.00 mL, Class A	each.....	14515-37
Pipet Filler, safety bulb	each.....	14651-00
PourRite Ampule Breaker, 2 mL	each.....	24846-00

In the U.S.A.—Call 800-227-4224

Outside the U.S.A.—Contact the Hach office or distributor serving you.