

## Methods

Iron is present in nature in the form of its oxides, or in combination with silicon or sulfur. The soluble iron content of surface waters rarely exceeds 1 mg/L, while ground waters often contain higher concentrations. The National Secondary Drinking Water Standard for iron is 0.3 mg/L, as iron concentrations in excess of 0.3 mg/L impart a foul taste and cause staining. High concentrations in surface waters can indicate the presence of industrial effluents or runoff.

Iron contamination in oil field brines are typically a result of corrosion processes of iron-containing metallic components and equipment. Accumulation of insoluble iron salts in a brine completion fluid can result in substantial formation damage and can significantly affect the productivity of an oil well. Quantifying total iron in brine is critical.

### The Phenanthroline Method (total & soluble; total & ferrous)

References: APHA Standard Methods, 22<sup>nd</sup> ed., Method 3500-Fe B - 1997. ASTM D 1068-77, Iron in Water, Test Method A. J.A. Tetlow and A.L. Wilson, "The Absorptiometric Determination of Iron in Boiler Feed-water", *Analyst*. Vol. 89, p. 442 (1964).

With the Phenanthroline Method, ferrous iron reacts with 1,10-phenanthroline to form an orange-colored chelate. To determine total iron, thioglycolic acid solution is added to reduce ferric iron to the ferrous state. The reagent formulation minimizes interferences from various metals. Results are expressed as ppm (mg/L) Fe.

### The PDTS Method (total)

References: G. Frederick Smith Chemical Co., The Iron Reagents, 3<sup>rd</sup> ed., p. 47 (1980). J.A. Tetlow and A.L. Wilson, "The Absorptiometric Determination of Iron in Boiler Feed-water", *Analyst*. Vol. 89, p. 442 (1964).

CHEMetrics' colorimetric method for determining total iron uses thioglycolic acid to dissolve particulate iron and to reduce iron from the ferric to the ferrous state. Ferrous iron then reacts with PDTS (3-(2-pyridyl)-5,6-bis(4-phenylsulfonic acid)-1,2,4-triazine disodium salt) in acid solution to form a purple-colored chelate. Results are expressed as ppm (mg/L) Fe.

### The Ferric Thiocyanate Method (Iron in Brine)

References: D. F. Boltz and J. A. Howell, eds., *Colorimetric Determination of Nonmetals*, 2<sup>nd</sup> ed., Vol. 8, p. 304 (1978). Carpenter, J.F. "A New Field Method for Determining the Levels of Iron Contamination in Oilfield Completion Brine", *SPE International Symposium* (2004).

The Iron in Brine test employs the ferric thiocyanate chemistry. In an acidic solution, hydrogen peroxide oxidizes ferrous iron. The resulting ferric iron reacts with ammonium thiocyanate forming a red-orange colored thiocyanate complex, in direct proportion to the iron concentration.

Results, expressed in mg/L, can be converted to mg/kg by dividing by the density of the brine.

## Visual Kits

**Range: 0-1 & 1-10 ppm**  
MDL: 0.05 ppm / Method: Phenanthroline

	Cat#
<b>Iron (total &amp; ferrous) CHEMetrics Kit</b>	<b>K-6210</b>
CHEMetrics Refill, 30 ampoules	R-6201
Activator Solution Pack, six 10 mL bottles	A-6000 <sup>1</sup>
Low Range Comparator 0, 0.1, 0.2, 0.3, 0.4, 0.6, 0.8, 1.0 ppm	C-6001
High Range Comparator 1, 2, 3, 4, 5, 6, 7, 8, 10 ppm	C-6010
Kit comes in a plastic case and contains everything needed to perform 30 tests: Refill, Low and High Range Comparators, Activator Solution, 25 mL sample cup and instructions.	

**Range: 0-1 & 1-10 ppm**  
MDL: 0.05 ppm / Method: Phenanthroline

	Cat#
<b>Iron (total &amp; soluble) CHEMetrics Kit</b>	<b>K-6010</b>
CHEMetrics Refill, 30 ampoules	R-6001
Activator Solution Pack, six 10 mL bottles	A-6000 <sup>1</sup>
Low Range Comparator 0, 0.1, 0.2, 0.3, 0.4, 0.6, 0.8, 1.0 ppm	C-6001
High Range Comparator 1, 2, 3, 4, 5, 6, 7, 8, 10 ppm	C-6010
Kit comes in a plastic case and contains everything needed to perform 30 tests: Refill, Low and High Range Comparators, Activator Solution, 25 mL sample cup and instructions.	

**Range: 0-30 & 30-300 ppm**  
MDL: 5 ppm / Method: Phenanthroline

	Cat#
<b>Iron (total &amp; soluble) VACUettes Kit</b>	<b>K-6010D</b>
VACUettes Refill, 30 ampoules	R-6001D
Activator Solution Pack, six 10 mL bottles	A-6000 <sup>1</sup>
Low Range Comparator 0, 5, 7.5, 10, 15, 20, 25, 30 ppm	C-6001D
High Range Comparator 30, 60, 90, 120, 150, 175, 200, 250, 300 ppm	C-6010D

Kit comes in a plastic case and contains everything needed to perform 30 tests (except distilled water): Refill, Low and High Range Comparators, Activator Solution, dilutor snapper cup, micro test tubes and instructions.

**Range: 0-1200 & 1200-12,000 ppm**  
MDL: 200 ppm / Method: Phenanthroline

	Cat#
<b>Iron (total &amp; soluble) VACUettes Kit</b>	<b>K-6010C</b>
VACUettes Refill, 30 ampoules	R-6001C
Activator Solution Pack, six 10 mL bottles	A-6000 <sup>1</sup>
Low Range Comparator 0, 200, 300, 400, 600, 800, 1000, 1200 ppm	C-6001C
High Range Comparator 1200, 2400, 3600, 4800, 6000, 7000, 8000, 10,000, 12,000 ppm	C-6010C

Kit comes in a plastic case and contains everything needed to perform 30 tests (except distilled water): Refill, Low and High Range Comparators, Activator Solution, dilutor snapper cup, micro test tubes and instructions.

**Range: 0-60 & 60-600 ppm**  
MDL: 10 ppm / Method: Phenanthroline

	Cat#
<b>Iron (total &amp; soluble) VACUettes Kit</b>	<b>K-6010A</b>
VACUettes Refill, 30 ampoules	R-6001A
Activator Solution Pack, six 10 mL bottles	A-6000 <sup>1</sup>
Low Range Comparator 0, 10, 15, 20, 30, 40, 50, 60 ppm	C-6001A
High Range Comparator 60, 120, 180, 240, 300, 350, 400, 500, 600 ppm	C-6010A

Kit comes in a plastic case and contains everything needed to perform 30 tests (except distilled water): Refill, Low and High Range Comparators, Activator Solution, dilutor snapper cup, micro test tubes and instructions.

**Range: 0-100 & 100-1000 mg/L**  
MDL: 5 mg/L / Method: Ferric Thiocyanate

	Cat#
<b>Iron in Brine CHEMets Kit</b>	<b>K-6002</b>
CHEMets Refill, 30 ampoules	R-6002
Acidifier Solution Pack, six 20 mL bottles	A-6001 <sup>1</sup>
Activator Solution Pack, six 20 mL bottles	A-6002 <sup>1</sup>
Low Range Comparator 0, 10, 20, 30, 40, 60, 80, 100 mg/L	C-6002
High Range Comparator 100, 200, 300, 400, 500, 600, 700, 800, 1000 mg/L	C-6012

Kit comes in a plastic case and contains everything needed to perform 30 tests (except distilled water): Refill, Low and High Range Comparators, Acidifier Solution, Activator Solution, 50 mL sample cup with cap, 1.0 mL syringe (2 ea) and instructions.

**Range: 0-120 & 120-1200 ppm**  
MDL: 20 ppm / Method: Phenanthroline

	Cat#
<b>Iron (total &amp; soluble) VACUettes Kit</b>	<b>K-6010B</b>
VACUettes Refill, 30 ampoules	R-6001B
Activator Solution Pack, six 10 mL bottles	A-6000 <sup>1</sup>
Low Range Comparator 0, 20, 30, 40, 60, 80, 100, 120 ppm	C-6001B
High Range Comparator 120, 240, 360, 480, 600, 700, 800, 1000, 1200 ppm	C-6010B

Kit comes in a plastic case and contains everything needed to perform 30 tests (except distilled water): Refill, Low and High Range Comparators, Activator Solution, dilutor snapper cup, micro test tubes and instructions.

*Instructions and MSDS(s) are posted on our website.  
If no shelf-life is listed for a product, then the shelf-life is at least 2 years.*



 Instrumental Kits

**Multi-Analyte Photometers**

V-2000 / V-3000 Series

(See page 14 for instrumental features)

**Range: 0-2.50 ppm**

Method: PDTS

**Iron (total) Vacu-vials Kit**

Cat#

K-6023

Kit comes in a cardboard box and contains everything needed to perform 30 tests: thirty ampoules, Activator Solution, 25 mL sample cup, ampoule blank and instructions.

**Range: 0-6.00 ppm**

Method: Phenanthroline

**Iron (total & ferrous) Vacu-vials Kit**

Cat#

K-6203

Kit comes in a cardboard box and contains everything needed to perform 30 tests: thirty ampoules, Activator Solution, 25 mL sample cup, ampoule blank and instructions.

**Range: 0-6.00 ppm**

Method: Phenanthroline

**Iron (total & soluble) Vacu-vials Kit**

Cat#

K-6003

Kit comes in a cardboard box and contains everything needed to perform 30 tests: thirty ampoules, Activator Solution, 25 mL sample cup, ampoule blank and instructions.

**Range: 0-25.0 ppm**

Method: Phenanthroline

**Iron (total & soluble) Vacu-vials Kit**

Cat#

K-6013

Kit comes in a cardboard box and contains everything needed to perform 30 tests: thirty ampoules, Activator Solution, 25 mL sample cup, ampoule blank and instructions.

*Vacu-vials Kits require the use of a CHEMetrics Direct-Readout Photometer (photometers sold separately) or a spectrophotometer capable of accepting a 13 mm diameter round cell. See page 14 for details.*

**Kit Components common to Iron**

Description	Cat#
Sample Cup Pack, 25 mL (6 ea)	A-0013
Micro Test Tube Pack, small (10 ea)	A-0015
Dilutor Snapper Cup Pack (6 ea)	A-0018
Ampoule Blank Pack (5 ea)	A-0023
Syringe Pack, 1.0 mL (6 ea)	A-0027
Sample Cup & Cap Pack, 50 mL (6 ea)	A-0058
Micro Test Tube Pack, 5 mL (5 ea)	A-0199

<sup>1</sup>The accessory pack supplies enough solution to perform at least 100 CHEMet or Vacu-vial tests and 42 VACUette tests. A-6000 Activator Solution is required for total iron analysis only.

*Instructions and MSDS(s) are posted on our website. If no shelf-life is listed for a product, then the shelf-life is at least 2 years.*

