

Program ID #33

Aluminum Auto-Test™ For Drinking Water

0.05 – 0.25 mg/L

The Orion AQUAfast IV Aluminum Auto-Test kit is intended for use with the Orion AQ4000 Advanced Colorimeter. For detailed setup and measurement procedures for the Orion AQ4000, consult your colorimeter manual.

NOTE: Before testing, zero the Orion AQ4000 using a sealed zero vial from the Orion AQUAfast IV Zero Auto-Test kit, Orion AQ4ZER. See the Orion AQ4000 manual for details on the Zero Procedure.

Safety Information

Read MSDS before performing this test. Wear safety glasses and gloves.

Neutralizer Solution Preparation

Fill the Neutralizer Solution bottle to the neck with distilled water. Shake the bottle until the dry chemical dissolves completely, then redilute to the neck and shake the bottle again to mix well. If the solution will be stored at room temperature, label the bottle with a 6-week expiration date. If it will be stored in the refrigerator, label it with a 3-month expiration date.

Sample Collection/Pretreatment

Collect samples in clean plastic containers. Preserve samples by adjusting the pH to 2 or less with nitric acid. Before analysis adjust sample pH to between 2.9 and 4.7 using solutions of nitric acid or potassium hydroxide.

Generating Reagent Blank Cuvette

A fresh reagent blank cuvette must be generated and used to set the blank in the instrument for each series of tests performed. Zero the Orion AQ4000 with the sealed zero cuvette before generating the reagent blank.

Careful preparation and analysis of the reagent blank is important for accurate aluminum results. If the reagent blank absorbance does not fall within the range of 0.190 to 0.245 (as displayed in step 13 below), prepare and analyze another reagent blank, following the instructions closely.

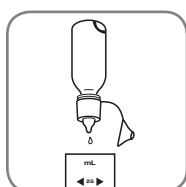


Figure 1

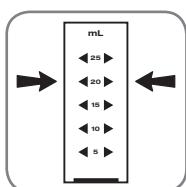


Figure 2

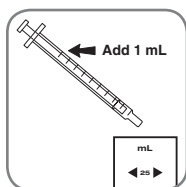


Figure 3

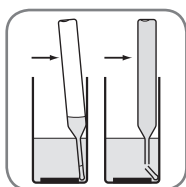


Figure 4

1. Add 10 drops of neutralizer solution to the sample cup. **See Fig 1.**
2. Fill the sample cup up to the 20 mL mark with deionized water. **See Fig 2.**
3. Wait 1 minute.
4. Add 1 mL of the activator solution using the 1 mL syringe supplied. **See Fig 3.** Stir briefly with the tip of the cuvette.
5. Place the Auto-Test cuvette in the sample cup and snap the tip by pressing the cuvette against the side of the cup. The cuvette will fill leaving a small bubble to facilitate mixing. **See Fig 4.**
6. Mix the contents of the cuvette by inverting it several times, allowing the bubble to travel from end to end each time. Wipe all liquid from the exterior of the cuvette.
7. Wait 7 minutes for color development.
8. Press the **prgm** key. Enter the ID code 33 and press the **yes** key.
9. Press the **setup** key and then press the **scroll** keys until “BLANK” is displayed.
10. Press the **yes** key, “SET BLNK?” will be displayed. Press the **yes** key, “SAMPLE?” will be displayed.
11. Insert cuvette into the Orion AQ4000. Align the ▼ on the Auto-Test cuvette with the ◆ on the adapter.
12. Immediately cover the cuvette with the cuvette cover.
13. Press the **yes** key and allow instrument to read blank. Blank value will be displayed and unit will proceed to the next setup function, which displays “VERIFY”.
14. Press the **meas** key to proceed to the measure mode.

NOTE: Since blank values are stored in memory, only a single blank measurement is required for each box or lot of Auto-Test reagents. A new blank should be set with each new box or lot of Aluminum Auto-Test reagent.

Test Procedure

1. Add 10 drops of neutralizer solution to the sample cup. **See Fig 1.**
2. Fill the sample cup up to the 20 mL mark with the sample. **See Fig 2.**
3. Wait 1 minute.
4. Add 1 mL of the activator solution using the 1 mL syringe supplied. **See Fig 3.** Stir briefly with the tip of the cuvette.



- Place the Auto-Test cuvette in the sample cup and snap the tip by pressing the cuvette against the side of the cup. The cuvette will fill leaving a small bubble to facilitate mixing. See Fig 4.
- Mix the contents of the cuvette by inverting it several times, allowing the bubble to travel from end to end each time. Wipe all liquid from the exterior of the cuvette.
- Insert cuvette into the Orion AQ4000. Align the ♦ on the Auto-Test cuvette with the ▼ on the adapter to obtain a continuous beeping and view ***** across the display. If ***** and beeping is not observed, rotate cuvette right or left to initiate the measurement.
- Immediately cover the cuvette with the cuvette cover.
- The Orion AQ4000 will begin a 7-minute countdown. After the countdown is completed, the Orion AQ4000 will automatically proceed to the measure mode.
- Record the concentration reading from the Orion AQ4000 display as either mg/L or ppm Aluminum or log measurement into the data logger by pressing the **log** key.

Test Method

The Aluminum Auto-Test cuvette test method is based on the reaction between aluminum and Eriochrome Cyanine R, which forms a red dye-lake.^{1,2} The amount of color present is directly proportional to the amount of aluminum present in the sample.

- APHA Standard Methods, 20th Edition ECR method, Page 3-56, method 3500-Al B (1998).
- Rapid Modified Eriochrome Cyanine R Method for Determination of Aluminum in Water, Kenneth E. Shull and Gene R. Guthan, page 1456 – 1468, J. AWWA, Nov 1967.

Interferences

Negative errors are caused by both fluoride and polyphosphates. When the fluoride concentration is constant, the percentage error decreases with increasing amounts of aluminum. If the fluoride concentration is known, the effect of fluoride can be determined from the fluoride correction table provided. Polyphosphate interference may be removed by a pre-digestion of the sample as outlined in the Standard Methods reference 1.

Ordering Information

Cat. No.	Description
AC4027	Orion AQUAfast IV Aluminum Auto-Test Kit
AQ4ZER	Orion AQUAfast IV Zero Vial Auto-Test Kit
AQ4CBL	Orion AQUAfast IV RS232 Cable
AQ4000	Orion AQUAfast IV Advanced Colorimeter

How to Use this Chart

Read the aluminum concentration from the Orion AQ4000. Find that value in the column on the left. Read across the chart to the column that matches the fluoride concentration of the sample. The value in the box (where the Orion AQ4000 reading intersects the fluoride concentration) is the actual aluminum concentration (mg/L) of the sample.

Correction for Fluoride Interference

AQ4000 Fluoride Adjustment Chart,

mg/L F⁻ concentration

AQ4000 Reading	mg/L F ⁻ concentration																			
	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	2	
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.010	0.011	0.013	0.014	0.016	0.017	0.020	0.024	0.027	0.031	0.034	0.038	0.042	0.045	0.048	0.050	0.050	0.050	0.050	0.050	0.050
0.020	0.022	0.025	0.028	0.031	0.034	0.037	0.040	0.044	0.047	0.050	0.055	0.060	0.065	0.070	0.075	0.075	0.075	0.075	0.075	0.075
0.030	0.033	0.038	0.042	0.046	0.050	0.053	0.056	0.060	0.063	0.067	0.075	0.083	0.090	0.098	0.100	0.100	0.100	0.100	0.100	0.100
0.040	0.044	0.049	0.053	0.057	0.063	0.067	0.071	0.076	0.080	0.084	0.092	0.100	0.108	0.117	0.125	0.130	0.140	0.155	0.150	0.150
0.050	0.056	0.060	0.065	0.070	0.075	0.080	0.085	0.090	0.095	0.100	0.110	0.120	0.130	0.140	0.150	0.160	0.165	0.170	0.175	0.175
0.060	0.066	0.070	0.079	0.084	0.088	0.095	0.100	0.105	0.110	0.117	0.127	0.137	0.147	0.157	0.167	0.176	0.175	0.194	0.200	0.200
0.070	0.077	0.083	0.089	0.095	0.100	0.110	0.115	0.120	0.125	0.134	0.143	0.153	0.163	0.173	0.184	0.193	0.185	0.209	0.217	0.217
0.080	0.088	0.096	0.102	0.110	0.117	0.125	0.130	0.135	0.140	0.150	0.160	0.170	0.180	0.190	0.200	0.209	0.220	0.230	0.234	0.234
0.090	0.099	0.108	0.117	0.126	0.134	0.140	0.145	0.150	0.155	0.163	0.171	0.181	0.192	0.203	0.212	0.224	0.232	0.240	0.250	0.250
0.100	0.110	0.120	0.130	0.140	0.150	0.155	0.160	0.165	0.170	0.175	0.183	0.193	0.204	0.214	0.225	0.237	0.240	0.250	0.250	0.250
0.110	0.120	0.130	0.140	0.150	0.160	0.166	0.171	0.176	0.182	0.188	0.193	0.204	0.215	0.226	0.237	0.250				
0.120	0.130	0.140	0.150	0.160	0.170	0.176	0.182	0.187	0.195	0.200	0.204	0.215	0.227	0.238	0.250					
0.130	0.140	0.150	0.160	0.170	0.180	0.187	0.193	0.198	0.207	0.213	0.216	0.226	0.238	0.250						
0.140	0.150	0.160	0.170	0.180	0.190	0.198	0.204	0.211	0.219	0.225	0.227	0.237	0.250							
0.150	0.160	0.170	0.180	0.190	0.200	0.208	0.217	0.225	0.232	0.239	0.238	0.250								
0.160	0.170	0.180	0.190	0.200	0.210	0.217	0.236	0.233	0.241	0.250	0.250									
0.170	0.180	0.190	0.200	0.210	0.220	0.228	0.243	0.241	0.250											
0.180	0.190	0.200	0.210	0.220	0.230	0.237	0.250	0.250												
0.190	0.200	0.210	0.220	0.230	0.240	0.246	0.250													
0.200	0.210	0.220	0.230	0.240	0.250	0.250														
0.210	0.220	0.230	0.240	0.250																
0.220	0.230	0.240	0.250																	
0.230	0.240	0.250																		
0.240	0.250																			
0.250																				

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