

# On-Line Chlorine Monitoring for Drinking Water Using US EPA Method 334.0

Water Analysis Instruments, Thermo Fisher Scientific

## Key Words

Chlorine, drinking water, on-line chlorine monitoring, UP EPA Method 334.0, chlorine analysis, Chlorine XP, chlorine analyzer, water quality monitoring, free chlorine measurement, total chlorine measurement.

## Goal

The following application note compares the chlorine readings taken from a Thermo Scientific™ Orion™ Chlorine XP™ water analyzer with an approved grab sample reference. If the readings of the two instruments agree within 0.1 mg/L, the Chlorine XP complies with US EPA Method 334.

## Introduction

Chlorine is the most commonly used chemical disinfectant in drinking water treatment plants in the United States. It can be used to oxidize the incoming source water, destroy pathogens in the water, and provide a residual (as chlorine or chloramines, when mixed with ammonia) in the distribution system to prevent re-growth of microbial contaminants.

When used appropriately, chlorine is an important tool for protecting public health. However, too little chlorine can lead to the public health hazard of unclean water, growth of microbial contaminants in the distribution system, and fines for violation of drinking water rules. Too much chlorine can lead to the public health hazard of disinfection byproducts (DBPs) formation, taste and odor problems, unnecessary chemical costs due to over-chlorination, and fines for exceeding chlorine levels. The benefits of careful monitoring and control of chlorine and chloramines levels in the plant are clear.



## Equipment Used:

- Thermo Scientific Orion Chlorine XP Water Quality Analyzer (Orion CXP72PH)
- Thermo Scientific™ Orion™ AQ3070 AQUAfast™ Chlorine Meter (Orion AQ3070)

## US EPA Method 334.0 for On-line Residual Chlorine Analysis

In September 2009, the United States Environmental Protection Agency (EPA) published EPA Method 334.0, “Determination of Residual Chlorine in Drinking Water Using an On-Line Chlorine Analyzer”. It was the first on-line chlorine method published by the EPA and approved for compliance monitoring of chlorine residuals in drinking water.

Water systems must use EPA-approved analytical methods when analyzing samples to meet federal monitoring requirements or to demonstrate compliance with drinking water regulations. Approved methods are developed by the EPA, other government agencies, universities, consensus methods organizations, water laboratories, and instrument manufacturers, and are listed in the Code of Federal Regulations after publication in a final rule.

EPA Method 334.0 gives clear guidance for what the EPA expects from a chlorine analyzer:

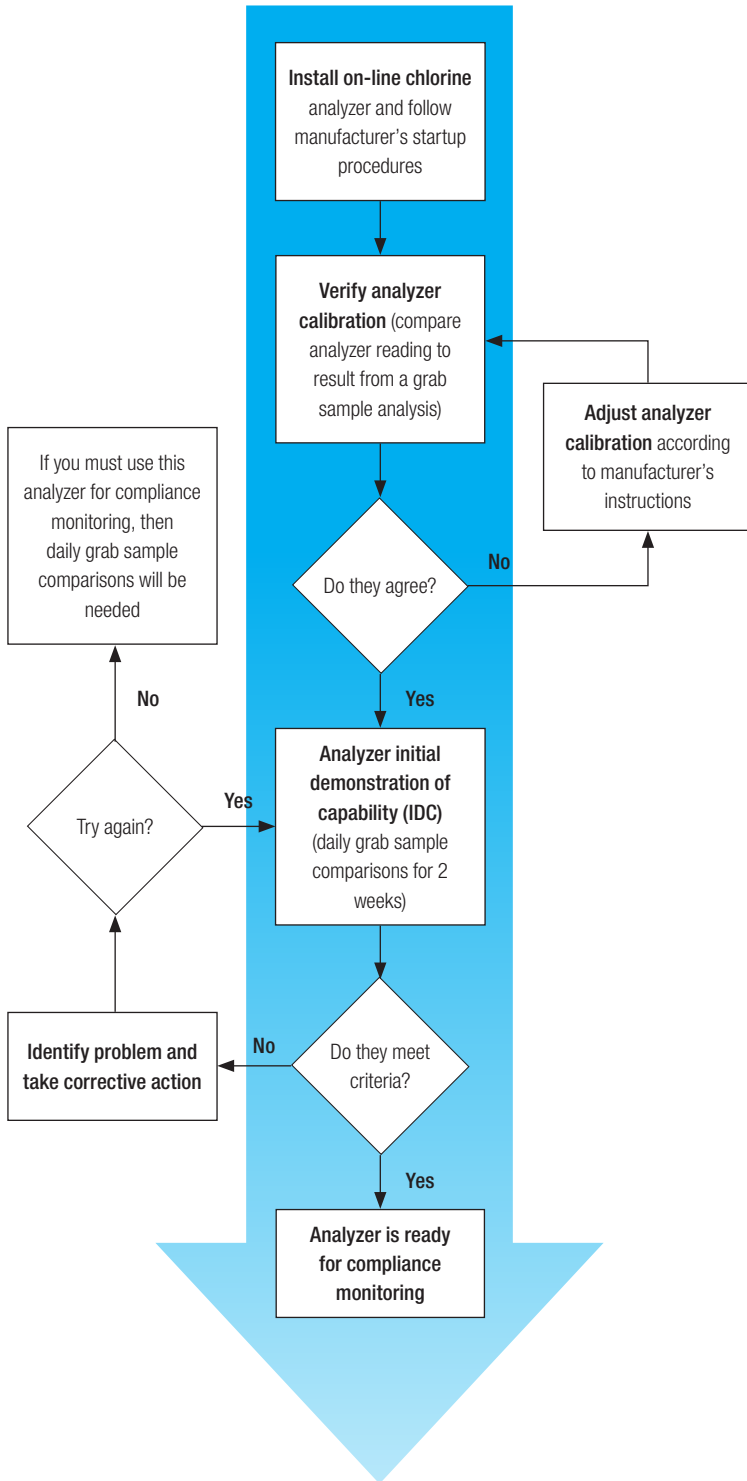
- Any type of chlorine analyzer is suitable, when used in conjunction with a grab sample reference method that is approved for drinking water compliance monitoring.
- Use for measurement of chlorine residuals (free or total) in the range of 0.2 – 4 mg/L.
- Calibrate using aqueous standards or results from paired grab samples, analyzed using an approved method.
- Conduct initial demonstration of capability. 14 days of comparison to grab sample results must agree to +/- 0.1 mg/L or 15%.
- Conduct periodic verification or adjustments based on results from the grab sample analyzer.
- Analyzer must have a read-out at the installation location and record data continually.
- Analyzer should have the capability to activate an alarm when the chlorine concentration falls outside the normal range.



## Chlorine XP Compliance with US EPA Method 334.0

The Start-up Quality Control (QC) procedures for the on-line chlorine analyzer were performed to demonstrate compliance of the Chlorine XP analyzer (per the US EPA Method 334.0). The EPA Method 334.0 flowchart is shown below on the left. The results of the Chlorine XP Start-up QC are described below on the right.

**Start Up QC for On-Line Chlorine Analyzers Flowchart**  
(Source: US EPA Method 334.0)



## Chlorine XP Results

### Installation

The Chlorine XP analyzer was installed following the EPA method's start-up procedures. The Chlorine XP model that measures both free and total chlorine measurement capability was chosen for testing.

### Verification

The Chlorine XP analyzer calibration was verified by comparing the analyzer readings to the results from a grab sample analysis using a Thermo Scientific Orion AQ3070 AQUAfast Chlorine Meter. The results agreed within 0.1 mg/L and it was not necessary to adjust the analyzer calibration.

### Initial Demonstration of Capability (IDC)

The Chlorine XP and grab sample were analyzed and compared twice daily for two weeks. Every grab sample comparison for free and total chlorine met the criteria. The Chlorine XP readings were always within +/- 0.1 mg/L of the grab sample; therefore, it was not necessary to take any corrective actions.

### Compliance

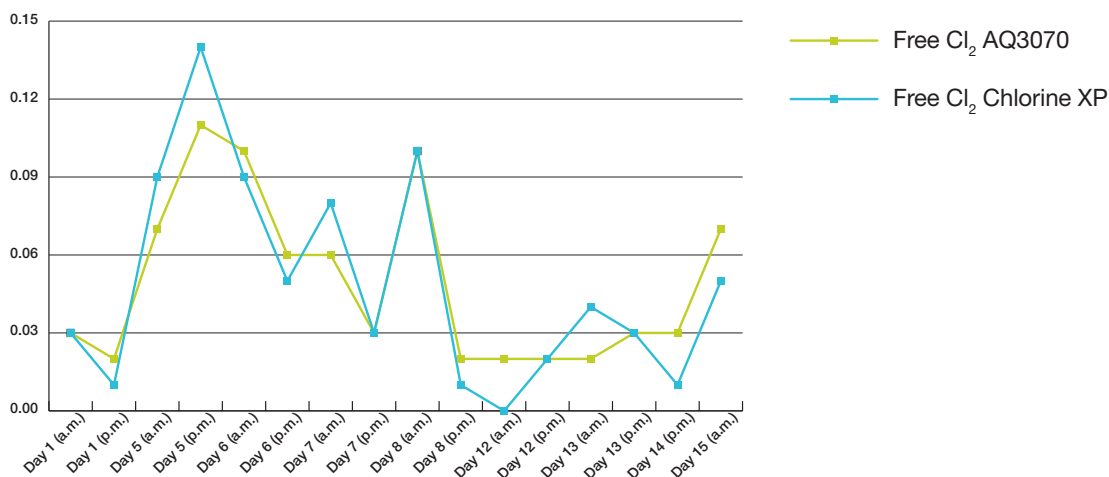
After two weeks of testing, the analyzer was ready for compliance monitoring.

The start-up QC for the Chlorine XP proceeded according to the blue arrow.

## Analysis

During the IDC phase, the Chlorine XP readings were compared with grab sample readings taken from the AQ3070 chlorine meter. The free and total chlorine readings from the Chlorine XP and grab sample were analyzed and compared twice daily for two weeks.

### Free Chlorine Readings



### Total Chlorine Readings



## Conclusion

Every grab sample comparison for free and total chlorine met the criteria for EPA Method 334.0. The Chlorine XP reading was always within +/- 0.1 mg/L of the grab sample. The Start-up QC proceeded straight through the flow chart with all criteria met and no iterations required.

## Summary

The Thermo Scientific Orion Chlorine XP Water Quality Analyzer meets the requirements of EPA 334.0 for drinking water analysis of residual chlorine. The analyzer can be configured to read free chlorine, total chlorine or both measurements, as well as pH and temperature - all in one analyzer.

[thermoscientific.com/chlorinexp](http://thermoscientific.com/chlorinexp)

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