Warranty

Trihalomethane Removal Equipment (TRE) Performance Warranty

Ixom Watercare ("Ixom") warrants to _____("Customer") that the Trihalomethane Removal Equipment ("TRE") supplied by Ixom will remove _____ % (the "Removal Rate") of the total trihalomethanes from the water within the reservoir or tank ("Tank") called the_____ _____, located at_____ _____ (address) in which it is to be installed, subject to the following provisions:

1. Design Parameters: This Performance Warranty is conditional upon the following design parameters being met. It is the Customer's responsibility to supply, along with any request pertinent to this Performance Warranty, adequate records demonstrating that the tank, water flow, and THMs are within the below parameters at all times for 5 days prior to and during performance testing of the Ixom TRE system.

Flow Information

Maximum flow through the tank, in millions of gallons per day, MGD: _____
Maximum pump fill rate for this tank, in gallons per minute: _____
Minimum water temperature, ˚F: _____

THM information

Minimum THMs in the inflow water, in ug/l or ppb: _____

2. Performance Testing. This Performance Warranty is also conditioned upon the Customer following the below procedures involving the testing of the Ixom TRE system.

a. Ensure that the TRE system is installed and operated in accordance with the owner's manual at all times.

b. The performance testing must be conducted within 60 days of the placement of the TRE system within the Tank.

c. Ixom must be given a written 5-working-day notice before performance testing is set to begin, to allow a Ixom representative to attend the testing.

d. With the 5-day notice above, the Customer should also supply to Ixom the name, address, contact person and phone number for the laboratory which will collect the THM samples and analyze them for the Customer, at the Customer's choice and expense, using EPA and ASTM approved methods.

2. Performance Testing (Continued)

e. The Customer and laboratory will use the below method for determining THMinadjusted (the THM into the tank + Formation Potential), and THMout (the THM out of the tank):

1) Operate the TRE system for 5 days continuously before the testing is conducted.

2) for THMinadjusted: Take the water sample from the fill pipe while the tank is filling, and age the sample for 1 day before adding a preservative to stop further THM formation. To replicate THM formation potential, the sample should be aged for approximately the same amount of time as the detention time in the tank, plus one day to account for the intense mixing in the tank. Age Time = (Tank Volume / Flow rate through the tank) + 1 day. Then test the sample for THM.

Customer is to send to Ixom the full laboratory report on how, when and where this sample was collected, a note on how long the fill pump was operating before the sample was collected, and a diagram of the collection point.

3) for THMout: Take the water sample from the outlet pipe when the tank has been drawn down to near the normal low level before the fill pump turns on. Follow standard lab protocol for adding a preservative immediately to stop further chlorine reactions, this is the “THMout”.

Customer is to send to Ixom the full laboratory report on how, when and where this sample was collected, and the tank level when the sample was collected, and a diagram of the collection point.

4) The THM reduction is calculated as:
THMreduction% = (1 - (THMout/THMinadjusted))x100

5) Repeat the above procedure two more times, for 3 total samples. Calculate the average THMreduction% for the 3 tests.

6) Send Ixom complete information on all 3 sampling events, the calculation of the average THMreduction% for the 3 tests, and a note showing how each of the design parameters in 1. above were measured and complied with.

3. Obligation Based on Design Parameters and Performance Testing.

a. TRE system deemed adequate and accepted. Ixom will be deemed to have met its obligations under this Performance Warranty, and the equipment accepted by the Customer, if either:

1) The average THM reduction during testing is equal to or greater than the % removal rate mentioned in the first paragraph of this performance warranty, OR

2) There has been insufficient verification put forth by the Customer, in Ixom's sole view, that the design criteria and other conditions of this performance warranty have been complied with from the time of delivery of the TRE system to the time of the initial THM testing mentioned above.

b. TRE system not deemed adequate or accepted. It will be deemed that the Ixom TRE system did not meet its obligations under this Performance Warranty if:

1) The average THM reduction during testing is less than the % removal rate mentioned in the first paragraph of this performance warranty, AND

2) There has been sufficient verification put forth by the Customer, in Ixom's sole view, that the design criteria and other conditions of this performance warranty have been complied with from the time of delivery of the TRE system through the time of THM testing mentioned above.

3) If the TRE system is not deemed adequate, then, at Ixom's option, it may elect any of the below options:

Customer to repeat the testing. If the removal results are still not adequate, then Customer and Ixom to negotiate either a) or b) below:

a) Ixom to add additional Ixom equipment at no cost to the Customer, with a limit of up to double the number of units that were purchased for this project. Not to include non-Ixom equipment (e.g. control panels) or additional electrical infrastructure required to power equipment, or

b) Negotiate with the Customer for the Customer to accept the equipment at a reduced price which is proportional to the average THM removal results during testing compared to the warranted results.

4. General Terms and Conditions of Sale

This THM Performance Warranty is subject to Ixom's General Terms and Conditions of Sale which have been made available to the Customer. To the extent of any inconsistency between the terms of this THM Performance Warranty and Ixom's General Terms and Conditions of Sale, the terms of this THM Performance Warranty shall prevail in relation to that inconsistency.

Warranty

Appendix A. Performance Testing and Evaluation

(link to full information: https://www.ixomwatercare.com/evaluating-thm-removal-performance)

Important THM Formation Potential Considerations

THM Formation Over Time: The amount of THMs mostly depend on chlorine concentration, bromine concentration, TOC concentration, temperature and pH. Only a small percentage of THMs are formed quickly. Converting THM precursors (often called THM formation potential or THMFP) into actual THMs is one of the slowest set of reactions in the entire water treatment industry and can take 50-80 hours to complete. In fact, it may never actually be completed though it does tend to reach a steady state.

Temperature Effect: Temperature has a large effect on the level of THMFP. For instance, a water sample @ 5℃ can result in THMFP of 50 ppb while the same water @ 35℃ can result in THMFP of over 200 ppb.
It should also be noted that water tends to warm up as it moves through the distribution system and water storage tanks. This warming can cause an increase in THMFP.

Mixing & Increased Detention Time:
Simple physics indicates the mixing provided by IXOM's SN Series THM Removal Systems helps all chemical reactions in water to occur; however, the conversion of THMFP into actual THMs is probably more about time than it is about mixing because in laboratories where researchers use continuous mixing and shaking of water samples, it still takes many hours to convert THMFP into THMs. So, the most important part of IXOM's mixing might be its effect on detention time.

Evaluating Performance Of THM Removal Systems

THM Removal Equation
The equation for THM removal is actually quite simple and can be expressed as follows:
R% = 100% - (THMout / THMinadjusted)
Where:
R% = THM removal achieved.
THMout = the THM out of the tank.
THMinadjusted = the THM going into the tank, adjusted upward by the amount of THMFP that was converted in the tank into actual THM = THMin + (THMFPout – THMFPin)

Recommended Sampling: If a lab or AMS Analyzer is not available to determine how much THMFP was converted into actual THM in the tank, then the Sample Aging Method can be used to give an approximation for THMinadjusted in the above formula:

1. For THMin, take a sample from the fill pipe while the tank is filling. This will be used later as the THMinadjusted sample. For the THMout, take the water sample from the outlet pipe when the tank has been drawn down to near the normal low level before the fill pump turns on.
2. For the Tank-Out water, follow standard lab protocol for adding a preservative to stop further chlorine reactions. Test the THM of the Tank-Out water.
3. For the THMinadjusted, age the sample first, before adding a preservative to stop further chlorine reactions. The sample should be aged for approximately the same amount of time as the detention time in the tank, plus one day to account for the intense mixing in the tank.
   Age Time = (TankVolume / Flowrate through the tank) + 1 day

   The THM test of this water will give an approximation of THMinadjusted in the above formula.