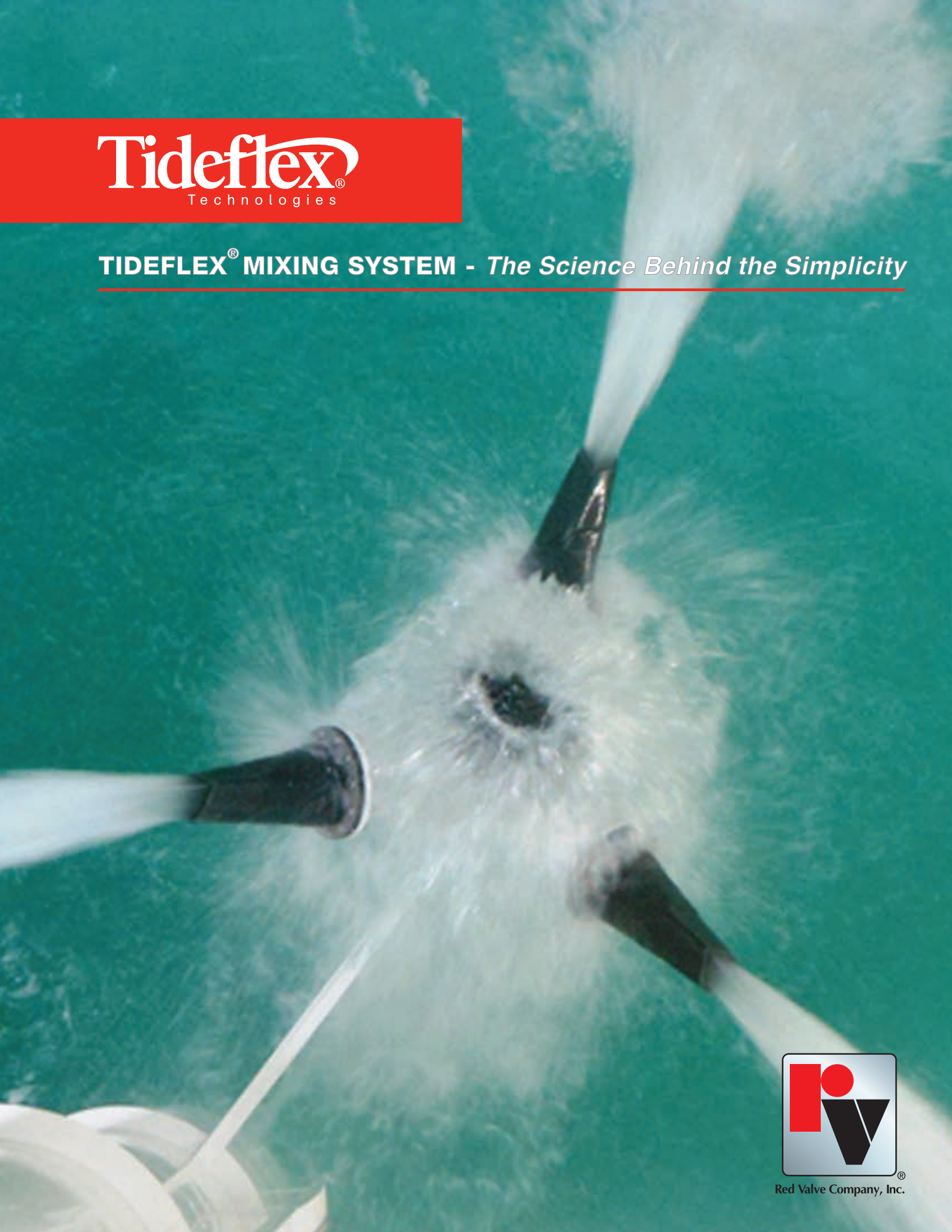

Tideflex®
Technologies
TIDEFLEX® MIXING SYSTEM - The Science Behind the Simplicity
Red Valve Company, Inc.®

Tideflex® Technologies

Custom Engineered for an Innovative Mixing Solution

TIDEFLEX® MIXING SYSTEM

The Science Behind the Simplicity

Since 1953, Red Valve Company has been the trusted global leader in developing innovative, custom-engineered valve products and mixing systems that solve flow control problems in both municipal and industrial applications.

Our dedication and drive has led us to an unparalleled approach to eliminate short-circuiting, water stagnation, and achieve complete mixing in water storage tanks - the Tideflex® Mixing System (TMS).

The key to the TMS is the Tideflex® Check Valve. Developed in the 1980s from a United States EPA grant, the check valve was created to solve backflow problems in outfall pipes.

Red Valve's engineering team further expanded the use of the Tideflex® Check Valve by developing it into a Variable Orifice Inlet Nozzle that provides superior mixing characteristics when compared to a fixed-diameter pipe. When used in the TMS, the Tideflex® Variable Orifice Nozzles optimize jet velocity at all flow rates and discharge an elliptically shaped jet, which produces rapid and complete mixing that improves water quality. The TMS also separates the inlet and outlet with one manifold pipe so short-circuiting is eliminated.

Tideflex® Variable Orifice Inlet Nozzles (All Rubber, No Mechanical Parts)

Benefits and Features of TMS:

- Extensive CFD and Physical Scale Modeling in every tank style.
- Field validated to achieve complete mixing in every tank style.
- Tideflex® Variable Orifice Nozzles maximize jet velocity, producing rapid mixing.
- No external energy source required.
- Expected life - 30 years, no maintenance.
- Complete custom system design with Mixing Analysis and Water Age Analysis.
- Installed in ANY size and style of tank.
- Only requires one pipe penetration in tank.
- Tideflex® Variable Orifice Nozzles and Waterflex® Outlet Check Valves are NSF 61 Certified.
- For tanks with common or separate inlet and outlet pipes.
- Passive and Active TMS available.

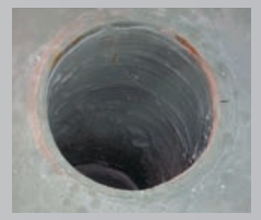
Waterflex® Outlet Check Valves (Rubber Membrane, No Mechanical Parts) (Not Required for Tanks With Separate Outlet Pipe)

TMS Solves Many Water Quality Problems Including:

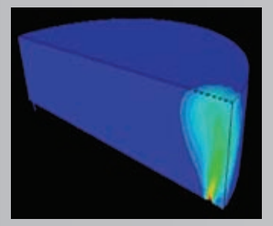
- Loss of disinfectant residual.
- Spikes in disinfection by-products (DBP).
- Nitrification in chloraminated systems.
- Bacteria and biofilm growth.
- Variations in pH and dissolved oxygen.
- Ageing water.
- Thermal stratification.
- Ice formation.
- Taste and odor issues.

Limitations of Conventional Tank Design

Conventional tank design typically incorporates a single fixed-diameter inlet pipe. This piping configuration is poor for mixing because it produces low jet velocity and concentrates all of the inflow momentum in one area of the tank. Inflow momentum is the energy responsible for mixing. When concentrated all in one place, a single fixed port will not effectively mix a tank.



Single fixed-diameter inlet pipe - low velocity.



Inlet flow in one location - inhibits mixing.

Problems with water quality are compounded in the summer because the colder water entering the tank is denser and negatively buoyant, causing it to sink. As a result, the water at the bottom of the tank is mixed well, but the water in the upper part of the tank does not mix and gets hotter each consecutive day. This leads to a localized increase in water age inside the tank. Even with an opposing outlet pipe, thermal stratification persists.

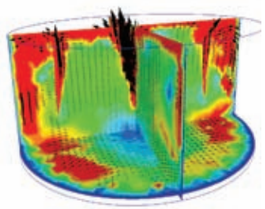
A fixed-diameter inlet pipe creates dead zones, short-circuiting, stratification and incomplete mixing, which results in water quality problems.

Stratified tank due to single inlet pipe.

TMS, a Green Solution to Improve Water Quality

TIDEFLEX® MIXING SYSTEM

The Science Behind the Simplicity

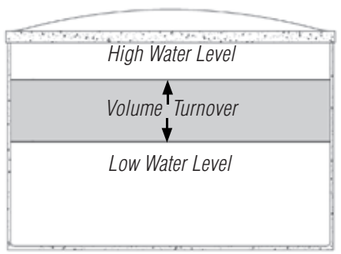


One of the keys to improving water quality in tanks is to ensure that the water is mixed to prevent short-circuiting and dead zones. By design, the distribution system utilizes existing pumps and valves, which then return each tank back to its highwater level. During a fill cycle, fresh water passes through multiple Tideflex® Nozzles, which create a circulation pattern throughout the entire water volume. This rapidly and completely mixes new water throughout the tank. Once the tank is mixed during the fill cycle, it does not "unmix" during the draw cycle.

Unlike mechanical mixers, there is no need to add an additional energy source to mix the water inside the tank. The owner paid for the energy source once when the finished water was pumped to fill the tank back to its high water level. Adding mechanical mixers is paying for energy twice. Having mixers submerged or floating inside the tank also puts an operation and maintenance cost burden on the owner because the motors will need to be replaced every few years, often requiring the tank to be drained. For tanks with minimal or no turnover, mixing 24/7 will not prevent water quality decay, as mechanical mixers just mix continually aging water. TMS is truly a "green" technology!

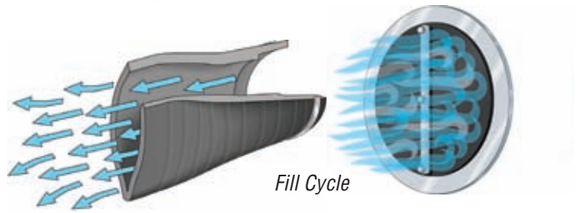
Maximize Volume Turnover to Minimize Water Age

Tanks are designed to have volume turnover and need turnover to minimize water age. A 5% daily volume turnover = 20 day average water age, 10% turnover = 10 day water age, 20% turnover = 5 day water age, and so on. AWWA recommends 20%-30% turnover for 3-5 day water age. Water utilities should operate their system to maximize tank volume turnover, which will minimize water age, resulting in increased disinfectant residuals, reduced DBPs and better water quality.

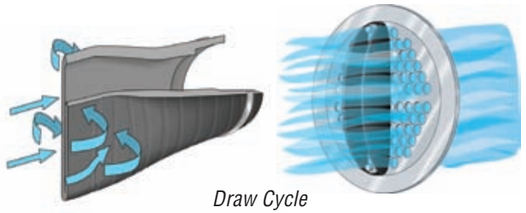


Achieves Complete Mixing, Eliminates Short-Circuiting

TMS Operating Principal - The TMS is a single multiport manifold system comprised of Tideflex® Inlet Nozzles and Waterflex® Outlet Check Valves that have no mechanical parts and operate solely on differential pressure. While the tank is filling, the Waterflex® Valves are closed and the tank fills through the Tideflex® Nozzles, which mix the tank completely. During a draw, the Tideflex® Nozzles are closed and water is drawn from the tank through flow efficient Waterflex® Valves.



Fill Cycle

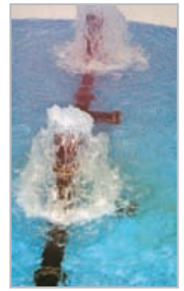


Draw Cycle

Maximized (Non-Linear) Jet Velocity of Tideflex® Nozzles Provides Rapid Mixing

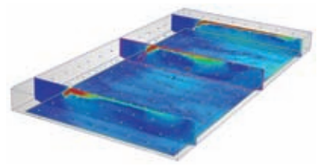
Unlike a fixed-diameter pipe, Tideflex® Nozzles act as a variable orifice. They open and close with increasing and decreasing flow, which maximizes jet velocity at all flow rates with low headloss, which produces rapid mixing.

Multiple Variable Orifice Tideflex® Nozzles



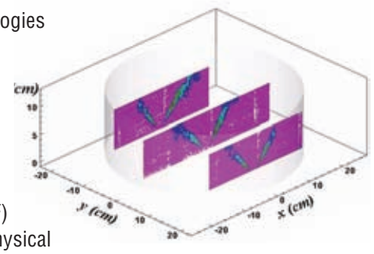
The key to the rapid and complete mixing with the TMS are the multiple Variable Orifice Tideflex® Nozzles that produce a minimum of 75% faster mixing than a single fixed-diameter pipe. In worst case summer conditions (colder inlet water), the multiple Tideflex® Inlet Nozzles have proven to completely mix tanks in comparison to a single inlet where all the flow momentum is in one location, resulting in short-circuiting and stratification.

Computational Fluid Dynamics (CFD) Modeling



Continuous CFD modeling allows Red Valve's engineering team to optimize TMS designs and configurations. Tideflex® Technologies has conducted hundreds of CFD models for almost every size and style of storage tanks.

Physical Scale Modeling



Tideflex® Technologies partnered with the Georgia Institute of Technology on a Water Research Foundation (WRF) project called "Physical Modeling of Mixing in Water Storage Tanks." Hundreds of experiments were conducted on single and multiple port manifolds to analyze mixing characteristics. Various tank styles were modeled under isothermal, negatively buoyant (colder inlet water) and positively buoyant (warmer inlet water) conditions. The TMS designs are based on the most efficient manifolds discovered in this project. The system has also been validated with independent scale modeling.

Field Validation

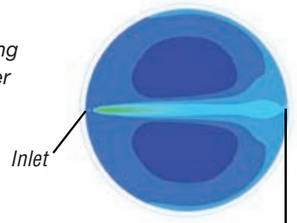
Through owner-conducted water quality sampling at various locations and depths throughout the tank, the TMS has been validated to achieve complete mixing and improve water quality in chlorinated and chloraminated systems in every tank style. The TMS has also been validated with full-scale tracer studies in a circular reservoir and elevated tank.

Custom Designed for Every Tank

Red Valve engineers custom design every TMS based on tank style, material, volume, dimensions, flow rates and volume turnover. Manifold hydraulics, mixing and water age models are run, as well as a jet trajectory analysis, to determine the quantity, size, orientation, elevation and discharge angles of both the Tideflex® Inlet Nozzles and Waterflex® Outlet Valves. A TMS Design Report is provided and includes TMS drawings, specifications, manifold hydraulics and Mixing and Water Age Analysis. The Mixing Analysis shows how much turnover is required to achieve complete mixing. The Water Age Analysis provides the average water age under current or proposed operating conditions.

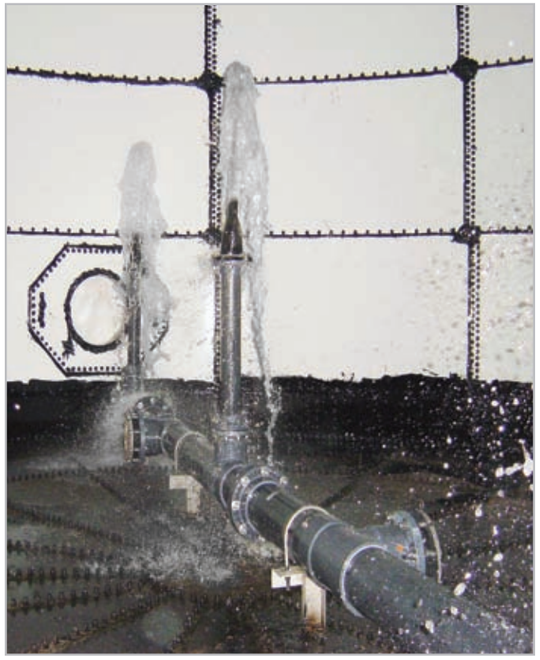
Caution

Separating the inlet and outlet pipes will not solve mixing and water quality problems. In almost every case, locating the outlet pipe the furthest distance from the inlet pipe is the wrong place. This will not prevent short-circuiting. A thorough understanding of circulation patterns and mixing is required in order to design a system that will completely mix the tank and eliminate short-circuiting.



Wrong Location of Outlet Pipe

TMS in Circular, Rectangular and Irregular Tanks

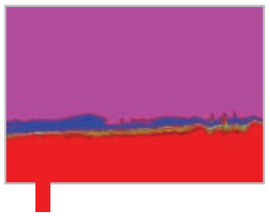


In circular, rectangular and irregularly-shaped reservoirs, the diameter or length is greater than the depth. A single fixed-diameter inlet pipe (common or separate from outlet pipe) results in short-circuiting, poor mixing and dead zones in areas away from the inlet because the momentum is concentrated in one localized area of the tank.

The TMS achieves complete mixing through a horizontal manifold with multiple Tideflex® Inlet Nozzles that distribute the momentum across the tank. The Waterflex® Outlet Valves are strategically located on the manifold to eliminate short-circuiting. For tanks with separate inlet and outlet pipes, the TMS is installed on the inlet pipe.

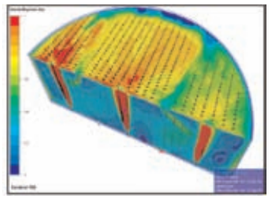
Problem

Poor mixing with a single fixed-diameter inlet pipe results in water quality problems.

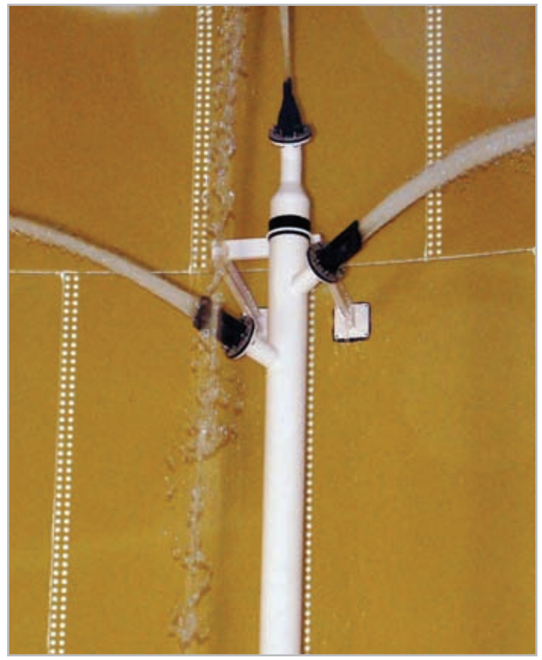


Solution

Multiple Tideflex® Inlet Nozzles circulate water throughout the tank with every fill cycle.



TMS in Standpipes

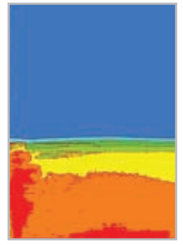


Standpipes are greater in depth than diameter and can exceed 140 feet (43 m) tall. They are extremely prone to short-circuiting, incomplete mixing and water quality decay, especially in summer when colder inlet water sinks, resulting in temperature stratification and increased water quality issues.

The TMS uses a vertical manifold with multiple Tideflex® Inlet Nozzles at various elevations, which distribute momentum throughout the depth of the tank and achieve complete mixing. To eliminate short-circuiting, the Waterflex® Outlet Valves are strategically located on the bottom of the TMS riser. For tanks with separate inlet and outlet pipes, the TMS is installed on the inlet pipe.

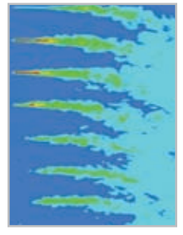
Problem

Standpipes are prone to stratification, incomplete mixing and poor water quality.



Solution

Complete mixing is achieved during every cycle by placing Tideflex® Inlet Nozzles vertically in the standpipe.



Tideflex® Technologies

Custom Design for Every Tank Style Based on Size, Volume, Dimensions, Flow Rates and Volume Turnover

TIDEFLEX® MIXING SYSTEM

The Science Behind the Simplicity

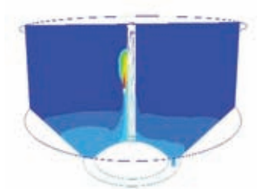
TMS in Dry Riser Elevated Tanks

Elevated tanks are prone to poor mixing in summer and icing in winter, due to a large surface area exposed to the sun and the elements. The inlet-outlet pipe of Sphere-Spheroid, Fluted-Column and Composite Elevated Tanks (CET) runs up the pedestal, or dry riser, and penetrates the bottom of the bowl.

For tanks with common inlet-outlet pipes, the TMS is a vertical manifold with Waterflex® Outlet Valves near the bottom of the bowl. This separates the inlet and outlet and eliminates short-circuiting. Multiple Tideflex® Inlet Nozzles are located at various elevations and discharge angles along the vertical riser to achieve complete mixing and will minimize the possibility of icing. For tanks with a separate outlet pipe, the TMS manifold is installed on the inlet pipe.

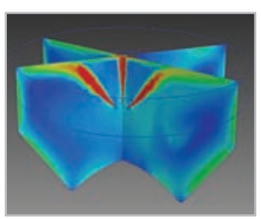
Problem

With so much of its area exposed to the elements, elevated tanks are prone to problems of poor mixing, stratification and water quality degradation.



Solution

Multiple Tideflex® Inlet Nozzles at multiple angles and elevations completely mix the tank.



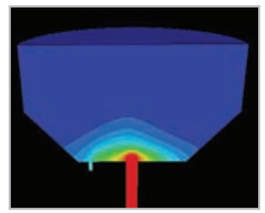
TMS in Wet Riser Elevated Tanks

Multi-column or multi-leg tanks are highly prone to water quality issues. Often the wet riser is 3-12 feet in diameter, running from ground level to the bottom of the tank, where it enters the bowl. At ground level, the inlet-outlet pipe penetrates the bottom of the wet riser and is significantly smaller in diameter than the wet riser. As a result, water velocity is severely reduced when it enters the wet riser from the inlet-outlet pipe. This drastically reduced velocity is not sufficient for mixing, making these tanks highly prone to thermal stratification and short-circuiting in warmer months when inlet water is colder. The colder water is denser and remains at the bottom of the tank during the fill cycle and the momentum of the inflow of the wet riser is almost always too low to provide complete mixing.

To achieve complete mixing, the Tideflex® Inlet Nozzles are located up in the bowl or vertical riser. Waterflex® Outlet Valves are located at the bottom of the wet riser, near ground level.

Problem

With a fixed-diameter inlet pipe at the bottom of the tank, only the water at the very bottom gets mixed.



Solution

The entire tank is mixed through Tideflex® Inlet Nozzles placed up in the bowl. This configuration prevents icing and other water quality problems.

Tideflex® Technologies

Hard At Work in Any Situation

TIDEFLEX® MIXING SYSTEM

The Science Behind the Simplicity

A Smarter Way to Achieve Active Mixing and Chemical Injection

The maintenance-free Passive TMS has proven to mix tanks and mitigate icing problems with as little as 5% volume turnover, while using the inherent energy source of the fill and draw cycles.

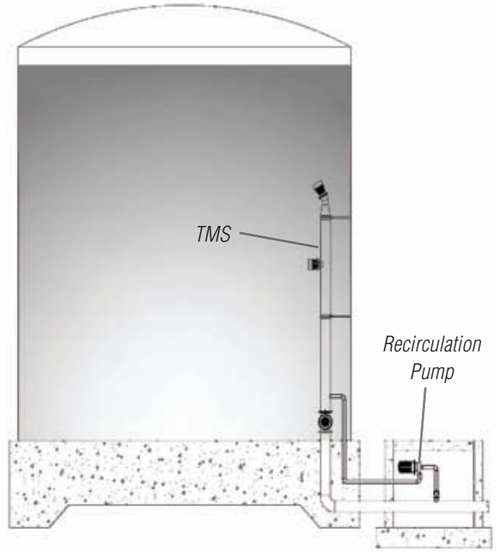
Active 24/7 mixing is almost never required. Installing floating or submerged mechanical mixers inside of storage tanks forces the owner to pay for an additional energy source, when the power has already been paid for once. It puts additional operational and maintenance costs on the owner, especially because mechanical mixers require maintenance and can be difficult to access.

For tanks with very low turnover or in extremely cold climates, the Passive TMS is easily made into an Active TMS using a recirculation pump, creating the Pass-Active TMS. This item can be utilized seasonally, as needed.

With the Pass-Active TMS, the passive TMS is installed in the tank, where it does not need maintenance. The recirculation pump is installed in the valve vault or an adjacent structure, where mechanical parts are easily inspected and maintained. The pump is low flow, head and energy because it pulls water from the tank and puts it back into the tank. Red Valve engineers size the recirculation pump and provide a Mixing Analysis.

Caution

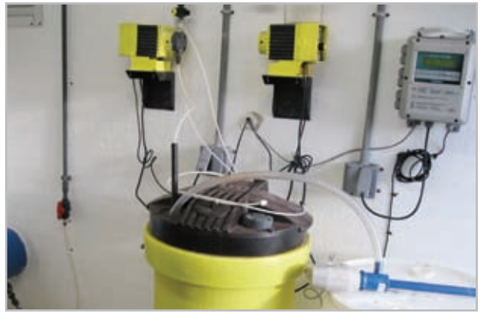
Mixing a tank 24/7 will not reduce water age. The Pass-Active TMS can also be used for forced drawdown where the pump discharges back into the distribution system to force the tank to draw down. Once the pump is called off, the tank refills and mixes through the passive TMS. Both mixing and water age are addressed with the forced drawdown scenario.



Pass-Active TMS keeps the pump outside the tank, for easy access and maintenance.

Safer, Easier Chemical Injection

The Pass-Active TMS can also be used for chemical injection to boost chlorine in free chlorine systems or chlorine and ammonia for systems on chloramines. Used in this way, the chemicals are completely mixed within the tank. This system eliminates the need to climb to the top of the tank to add chemicals. It ensures that water of a more consistent quality is leaving the tank.



A Secure, Reliable Choice for Overflow and Drain Pipes

Municipalities are challenged with protecting water storage tanks against contamination. Insects, rodents, birds, or tampering can cause serious health risks. Tideflex® Check Valves provide a reliable, cost-effective and maintenance-free solution compared to screens and flap valves.

Either flanged, or clamped onto the end of an overflow pipe, Tideflex® Valves are very reliable for overflow pipe protection. The all-rubber construction of Tideflex® Valves prevent rust, corrosion, and mechanical failure. Because they are non-mechanical, Tideflex® Overflow Valves do not require maintenance and will drain completely after an overflow event.

Tideflex® Valves are virtually impossible for rodents, birds and insects to penetrate. Unlike mesh screens and flapgate valves, Tideflex® Check Valves will not corrode, dislodge, freeze open or shut.

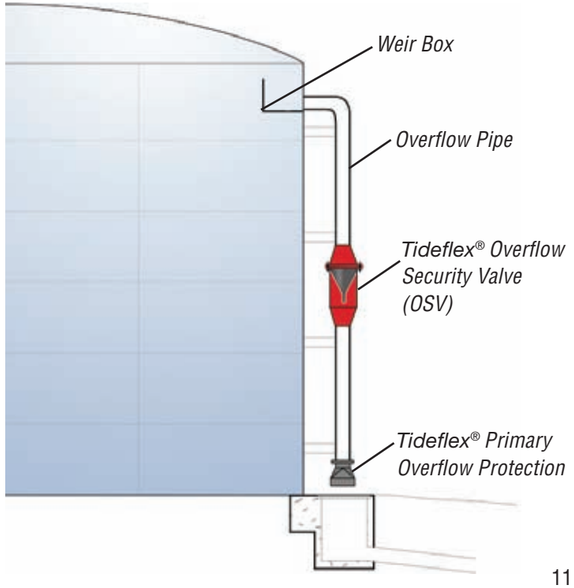
Tideflex® Valve still discharging water at -35° F.

Overflow Security Valve (OSV)

After 9/11, Red Valve Company's engineering team developed the Overflow Security Valve (OSV) to help our water utility customers address the increased need to secure their water supply from a potential terrorist attack. The OSV assembly incorporates a Tideflex® Series 37 Valve and is either welded or flanged to the overflow pipe with tamper-proof bolts.

With the OSV installed above the end of an overflow, you achieve two deterrents; the Tideflex® Series 37 cannot be seen, and it is extremely difficult to access, manipulate or damage.

Red Valve engineers provide a detailed Overflow Pipe Hydraulic Analysis to size and locate the Tideflex® Valve and/or OSV, based on tank dimensions, overflow pipe size and material, air gap distance and peak flow rate.



Field Validation and Water Quality Sampling Equipment

The Tideflex® Mixing System (TMS) has been installed in thousands of tanks and reservoirs as small as 2,000 gallons, to over 150.0 million gallons. The TMS has been field validated in every tank style with sampling and monitoring studies conducted by water utilities, proving it improves storage tank water quality.

Whether you would like to determine if your tanks are stratified, or if you have mixing systems and want to confirm the tanks are mixed, Tideflex® Technologies has water quality sampling equipment available to sample your tank water quality throughout the depth.

The available monitoring equipment and services include:

- Temperature Data Logger (TDL) Strings that continuously monitor temperature within your tank for an extended period of time. The Data Loggers are pre-programmed for deployment.
- Depth Samplers that obtain grab samples at various depths within your tank for water quality analysis.
- Pocket Colorimeters that can be used to obtain free and total chlorine residuals.

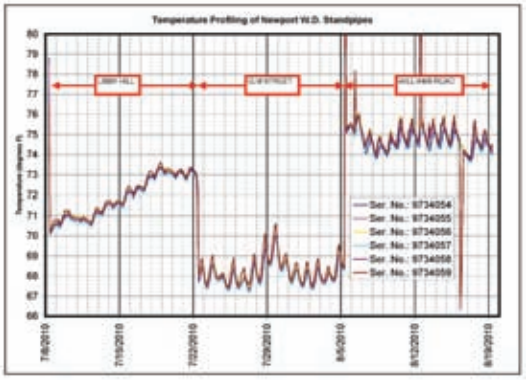
Once the equipment is returned, the data is downloaded and analyzed. A report with the data is compiled and provided to the customer.

Contact Tideflex® Technologies for more information about these services.

Temperature Data Logger String

Depth Sampler

Colorimeter



Temperature Profiling Chart

The products contained in this brochure are covered under one of the following patent numbers:

US 7,104,279 (US),
US 6,016,839 (USA),
CA 2,409,009 (Canada).

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