Tideflex®

MIXING SYSTEM

FOR FINISHED WATER STORAGE FACILITIES

Tideflex® Mixing System

Improving Water Quality in Distribution Reservoirs

- Prevents short-circuiting, stagnation and "dead zones"
- Separates inlet/outlet with one manifold pipe
- Tideflex® variable orifice maximizes jet velocity for improved mixing
- Eliminates thermal stratification
- Mitigates ice formation
- Uses existing tank penetration
- Completely passive; no external energy source
- Tideflex and Waterflex are ANSI/NSF Standard 61 Certified
- Complete system design and hydraulic sizing

Water quality in finished water storage facilities is one of the most important issues facing water utilities today, especially in light of recently adopted and proposed regulations. Low turnover, poor mixing and short-circuiting within distribution storage tanks can result in water quality problems such as:

- Loss of disinfectant residual
- Bacterial re-growth
- Disinfection by-product (DBP) formation
- Nitrification in chlorinated systems
- Algae and Biofilm growth
- Taste and odor complaints

The Tideflex® Mixing System (TMS) is a cost-effective solution that can be easily installed in new or existing tanks and reservoirs. The TMS eliminates short-circuiting and improves mixing thereby maintaining the highest water quality in your tanks and reservoirs.

Patented Allowed

ELIMINATE SHORT-CIRCUITING

Short-circuiting is most severe with common inlet/outlet pipes (**Figure 1**) or when the inlet and outlet are in close proximity to one another. The last water put into the tank is the first water that is drawn out (last-in, first-out). Stagnant areas develop outside this area of influence and the water in these areas can be days or weeks old, resulting in the loss of disinfectant residual.

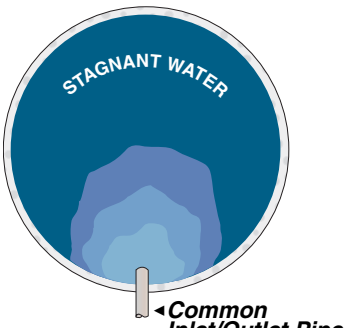


Fig. 1

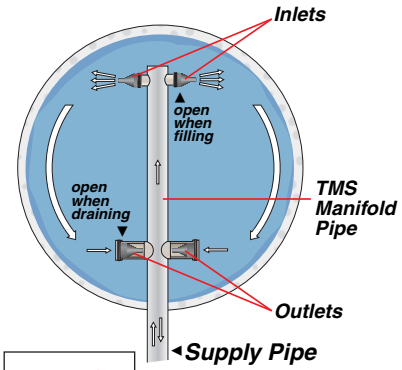
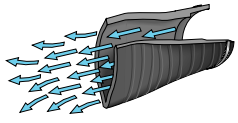


Fig. 2

Locating inlet and outlet pipes at opposite sides of the tank will mitigate short-circuiting. Prior to the TMS, this meant installing two separate pipes and two tank penetrations, a valve vault outside of the tank, extra isolation and check valves, etc. The TMS achieves inlet/outlet separation with a single manifold pipe installed inside the reservoir. Two sets of Tideflex® Check Valves located on opposite ends of the manifold function as inlets and outlets (**Figure 2**). Tideflex® valves are an all-rubber/fabric matrix and have no mechanical parts. They are completely passive and operate solely on differential pressure (**Figure 3**) so the tank fills and draws based on distribution system and tank head without any outside energy source. Significant cost savings are realized compared to other methods of separating the inlet and outlet.

Fig. 3



Forward differential pressure progressively opens the valve

Reverse differential pressure closes and seals the valve

▶ENHANCED JET VELOCITY IMPROVES MIXING

AwwaRF research has shown that distribution system storage facilities should operate in a completely mixed state rather than plug flow (i.e. baffles). Mixing of water inside a reservoir is dominated by the inlet flow momentum (flow x velocity). Maximizing the flow rate and/or velocity improves mixing and reduces the fill time required to achieve a completely mixed reservoir.

Tideflex® Mixing Nozzles are inherently a variable orifice as they progressively open/close with the increase/decrease in flow rate. This results in an optimized (non-linear) jet velocity profile at all flow rates compared to a pipe and fixed-diameter orifice (**Figure 4**). At peak flow rate, the Tideflex® has an equivalent jet velocity compared to a fixed diameter port. However, as flow rates decrease, the Tideflex® progressively closes which results in higher jet velocity. At lower flow, Tideflex® can generate 4-5 times greater jet velocity than a fixed diameter port.

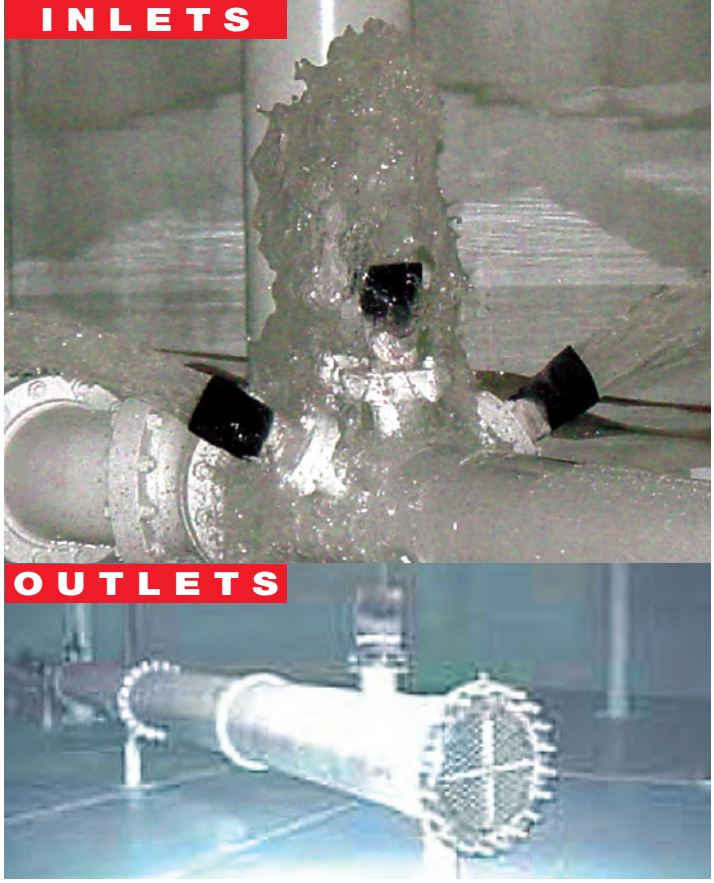


Fig. 4

Jet Velocity vs. Flow

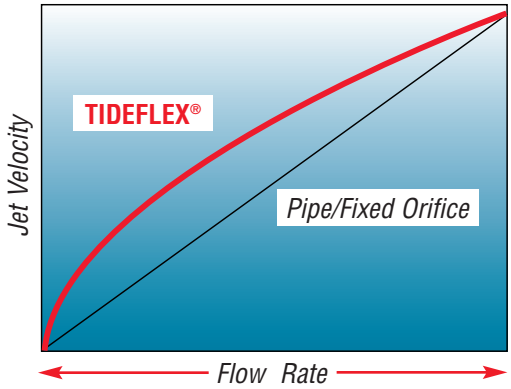
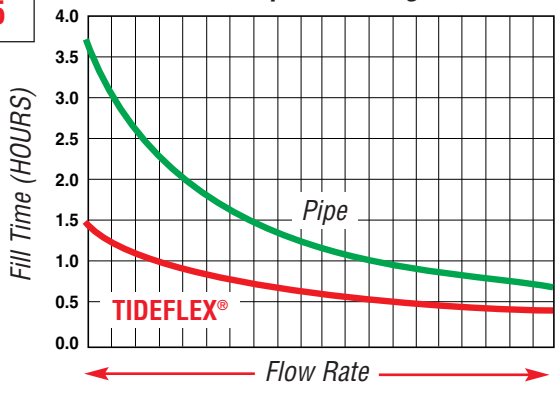


Fig. 5

Fill Time Required for Complete Mixing



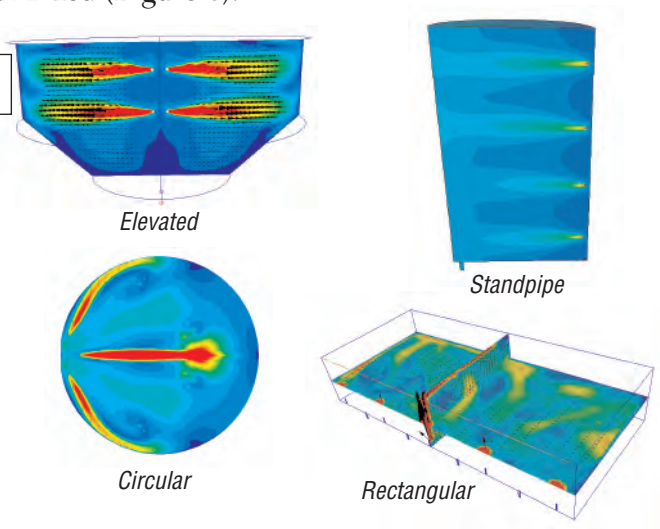
The advantage of the enhanced jet velocity is illustrated in (**Figure 5**) which is a graph of theoretical fill time required to achieve complete mixing. The equation is based on tank volume and inlet momentum. At higher flows, the fill time required is nearly equivalent for the pipe/fixed orifice and Tideflex® Valve. However, at lower flows, the Tideflex® mixes the tank faster than the pipe since the jet velocity and momentum are higher.

▶OPTIMIZE INLET/OUTLET DESIGN

While separating the inlet and outlet is a drastic improvement regarding short-circuiting, a dedicated inlet pipe can still induce circulation patterns that result in stagnant areas and dead zones, especially when there are temperature differences between the water in the tank and the water coming from the distribution system. The configuration (number, size, and orientation) of the inlet(s) is critical to ensure that stagnant areas and dead zones are mitigated.

Tideflex® Technologies continually conducts extensive CFD (Computational Fluid Dynamics) modeling for various styles of tanks to determine the optimal configuration of the Tideflex® Diffuser inlets to ensure dead zones are minimized and mixing efficiency is maximized (**Figure 6**).

Fig. 6



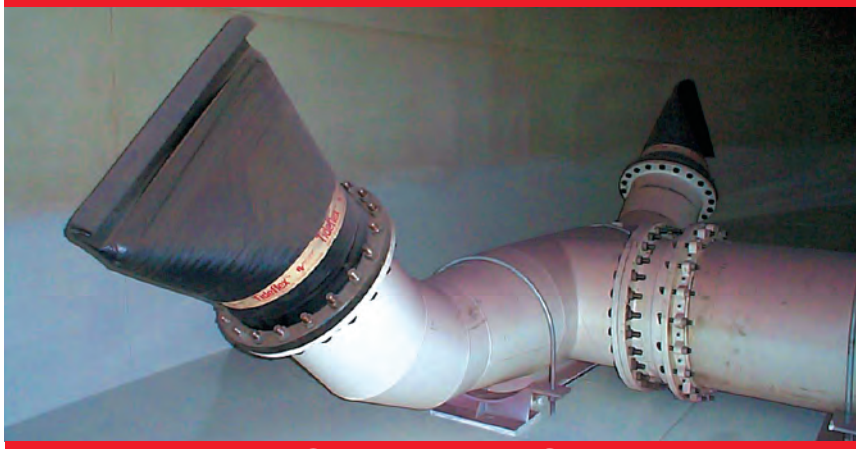
Circular & Rectangular
Ground Level Reservoirs

Ground level tanks are constructed of a variety of materials including welded steel, concrete, and glass-fused bolted steel. Typical inlet/outlet tank penetrations are horizontal through the shell or vertical through the floor. Conventional tank design included a common inlet/outlet pipe of a diameter that only generates 2 - 4 fps jet velocity at average fill rates. Tideflex® Mixing Systems are generally sized for 8 - 10 fps jet velocity.

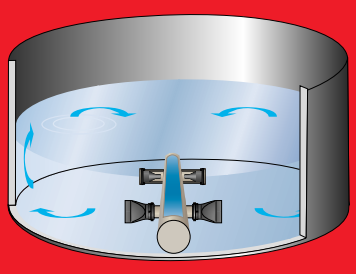
Prior to the Tideflex® Mixing System (TMS), one method used to separate the inlet/outlet pipe included a separate pipe around the perimeter of the tank or under the tank floor. This required two tank penetrations, the two pipes to be joined in a vault outside of the tank, extra fittings, isolation valves, etc.

Tideflex® Technologies has various TMS designs available based on the dimensions of the tank. The TMS is connected to the tank penetration via a flange fitting or coupling. The manifold pipe is laid along the floor on pipe supports. Tideflex® Mixing System is available in various pipe material. Typically, one set of Tideflex® Valves is installed on the far side of the tank for filling, another set of Tideflex® is installed on the near side of the tank, near the tank penetration for draining. Field data has shown the TMS resulted in increased and more consistent disinfectant residuals throughout the water volume.

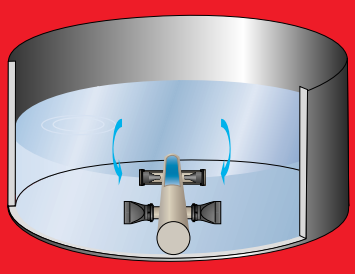
INLETS



OUTLETS



Fill Operation



Draw Operation

Rectangular reservoirs are prone to poor mixing because the corners of the tank dampen velocity and generate significant dead-zones. The TMS design eliminates the corner effects and provides uniform mixing.

Elevated Storage Tanks

DRY RISER

Elevated storage tanks come in many styles and are typically constructed of steel or a composite (concrete and steel). In a dry riser, the inlet/outlet pipe is installed inside the riser and penetrates the bowl. Near the penetration, Tideflex® outlet valves are installed in a flanged cross fitting (**Figure 7**). A TMS riser pipe is installed above the outlet valves and is braced to the access tube (**Figure 8**). Multiple Tideflex® inlet valves are installed at various positions along the height of the riser depending on the dimensions of the tank, flow rates, and typical draw-down levels. With this TMS configuration, fresh water is introduced into the tank near the top of the bowl, and water is drawn from the tank toward the bottom of the bowl.

INLETS

Fig. 8

OUTLETS

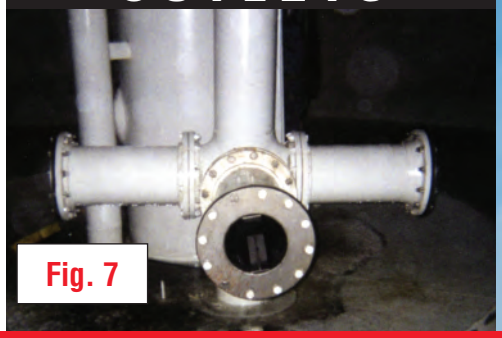


Fig. 7

WET RISER

Elevated tanks with wet risers are known for poor mixing because the “inlet" into the bowl is the large-diameter wet riser itself, not the smaller inlet/outlet pipe. Momentum is greatly reduced since the water velocity entering the bowl is much lower. In wet riser elevated tanks, the Tideflex® outlet valves are installed in a cross fitting at the bottom of the wet riser near ground level (**Figure 9**). A vertical pipe is installed above the outlet valves and is braced off the inside of the wet riser. The TMS riser terminates just inside the bowl where one or more Tideflex® inlet valves are installed (**Figure 10**).

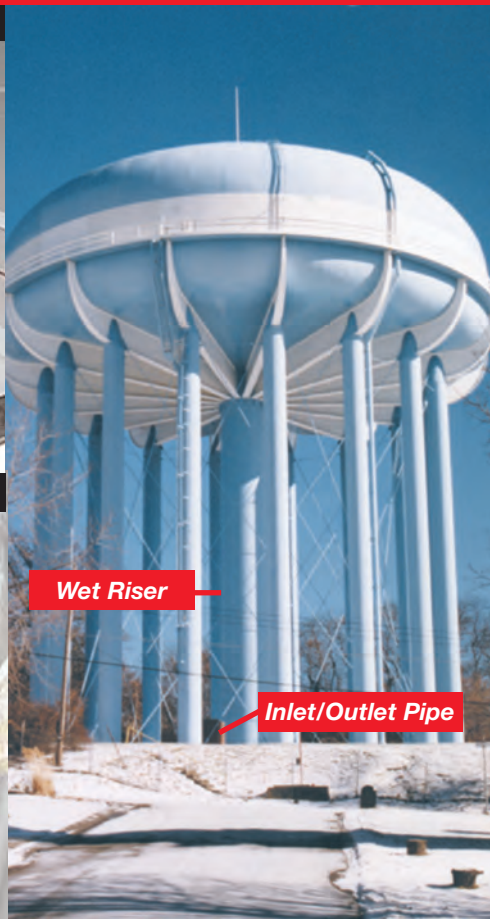
Another benefit of the TMS is that it will mitigate ice formation in dry and wet riser tanks. A well-mixed tank will preclude stagnant zones that are prone to freezing. Since the Tideflex® inlets are located higher in the tank, they produce direct turbulence on the water surface.

INLETS

Fig. 10

OUTLETS

Fig. 9



Standpipes

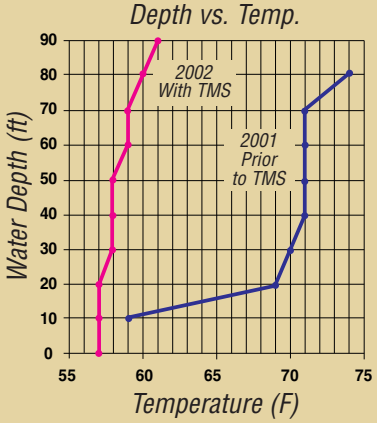
Standpipes are particularly prone to thermal stratification due to their depth. Stratification is most severe during summer when the inlet water is colder than the water inside the tank. The colder water is denser and tends to remain at the bottom of the tank (**Figure 11**). This results in very little or no mixing and long detention time in the upper portions of the tank. Also, the fresh water at the bottom of the tank is the first to be drawn into the distribution system so short-circuiting in standpipes is prevalent.

For standpipes, the TMS inlet and outlet are typically separated in the vertical direction - the inlets toward the top and outlets at the bottom. This configuration reduces or eliminates stratification. In addition, multiple inlet diffusers are used to provide rapid mixing compared to a single inlet (**Figure 12**). The outlet valves are installed in a fitting near the tank penetration (**Figure 13**). The vertical riser pipe is installed above the fitting and is braced to the shell of the tank.

Fig. 11

Another benefit of the TMS is that it will mitigate ice formation. A well-mixed tank will preclude stagnant zones that are prone to freezing. In addition, since the Tideflex® inlets are located higher in the tank, they provide direct turbulence on the water surface.

TEMPERATURE STUDY BEFORE AND AFTER TMS



A temperature study was conducted on a 1.3 million gal. standpipe in Dennis, MA. In the summer of 2001, temperature data showed severe thermal stratification. In the summer of 2002 after the installation of the TMS, the temperature data showed that stratification had been virtually eliminated.

Field study courtesy of Dennis, Massachusetts

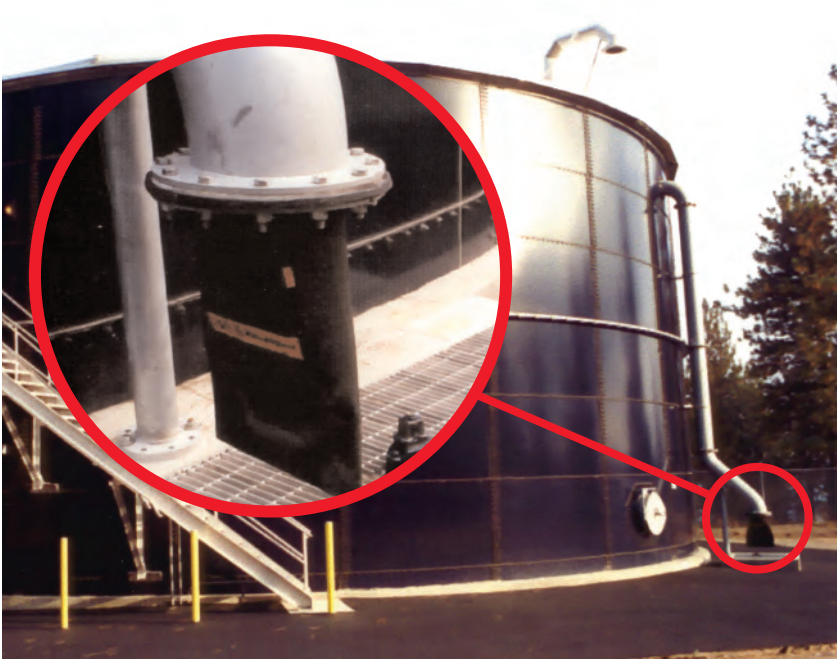
INLETS

Fig. 12

OUTLETS

Fig. 13

Overflow Pipe Protection

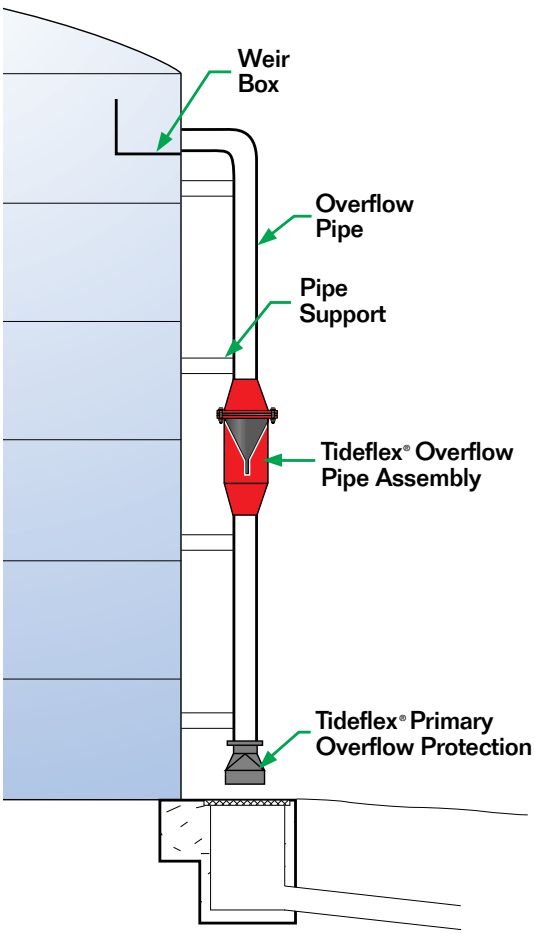


Overflow Pipe Protection

Across the country, municipalities are growing increasingly concerned about protecting America's water storage tanks against contamination. Whether you're facing rodents, birds, insects or the risk of tampering, Tideflex® Check Valves provide a reliable solution.

Tideflex® Check Valves can be easily slipped over or bolted to the end of overflow pipes. They are self-draining and will not leave standing water in the overflow pipe. In addition the Tideflex® Check Valves are very difficult to open manually, and virtually impossible for rodents, birds and insects to penetrate.

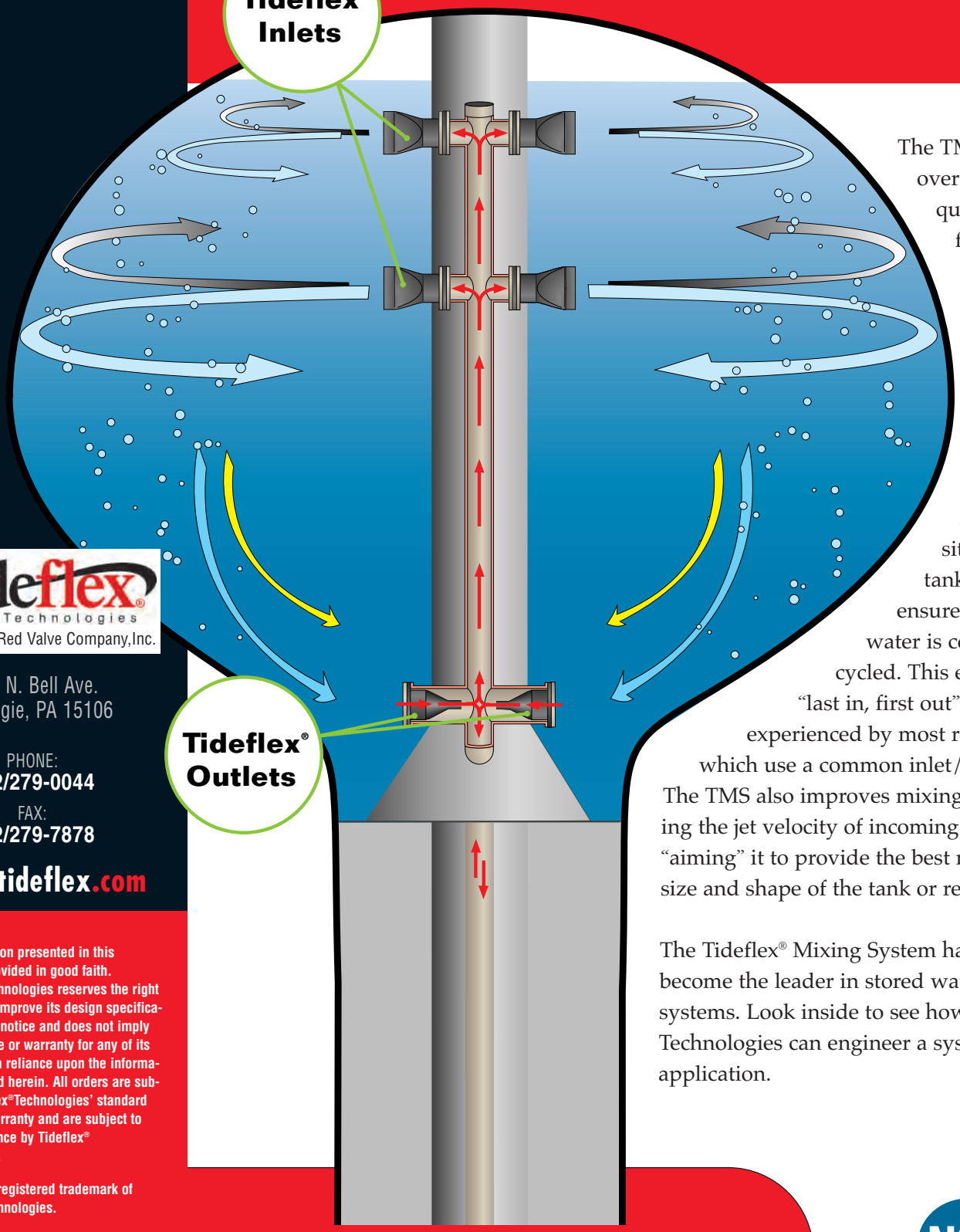
Unlike mesh screens and flapgate valves, Tideflex® Check Valves will not corrode, dislodge or freeze open or shut. And installation is a snap. Tideflex® Check Valves provide a quick, cost-effective, virtually maintenance-free solution for municipalities coast to coast.



Tamper Resistant Overflow Security Assembly

Security has become an important part of any water storage facility, and Tideflex® Technologies' Overflow Protection products play a critical part in an overall security program. The tamper-resistant Overflow Security Assembly consists of our patented Tideflex® Check Valve, housed in a metal body. The body allows an oversized valve to be used, to retain the full flow capacity of the overflow pipe. The assembly is ready-to-install; the pipe is simply cut and the assembly is welded into place. Once installed, the valve is out-of-sight and unreachable. Designs for overflow pipes fabricated from materials other than steel are also available.

Improve Water Quality with the Tideflex® Mixing System (TMS)



The TMS improves overall water quality within finished water storage reservoirs by eliminating stagnation and stratification. By filling and draining from opposite sides of a tank, the TMS ensures that all water is continually cycled. This eliminates the "last in, first out" problem experienced by most reservoirs which use a common inlet/outlet point. The TMS also improves mixing by increasing the jet velocity of incoming water, and "aiming" it to provide the best mix for the size and shape of the tank or reservoir.

The Tideflex® Mixing System has quickly become the leader in stored water mixing systems. Look inside to see how Tideflex® Technologies can engineer a system for your application.

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TM 0508

Eliminate Stagnation in Finished Water Storage Tanks

NSF®

The products contained in this brochure are covered under one of the following patent numbers: U.S. patent no. 4492253, 4523738, 4585031, 4603864, 4607663, 5606995, 5727593, 5769125, 6412514, 701194, 5931197, 6016839, 2326603 U.K. In addition other U.S. and Foreign patents pending.