Red Valve

Tideflex® Diffuser Nozzles for Multiport Effluent Outfalls

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The World Leader in Pinch and Check Valve Technology™

Your Partner in Engineering, Design and Technical Analysis for Effluent Diffuser Systems

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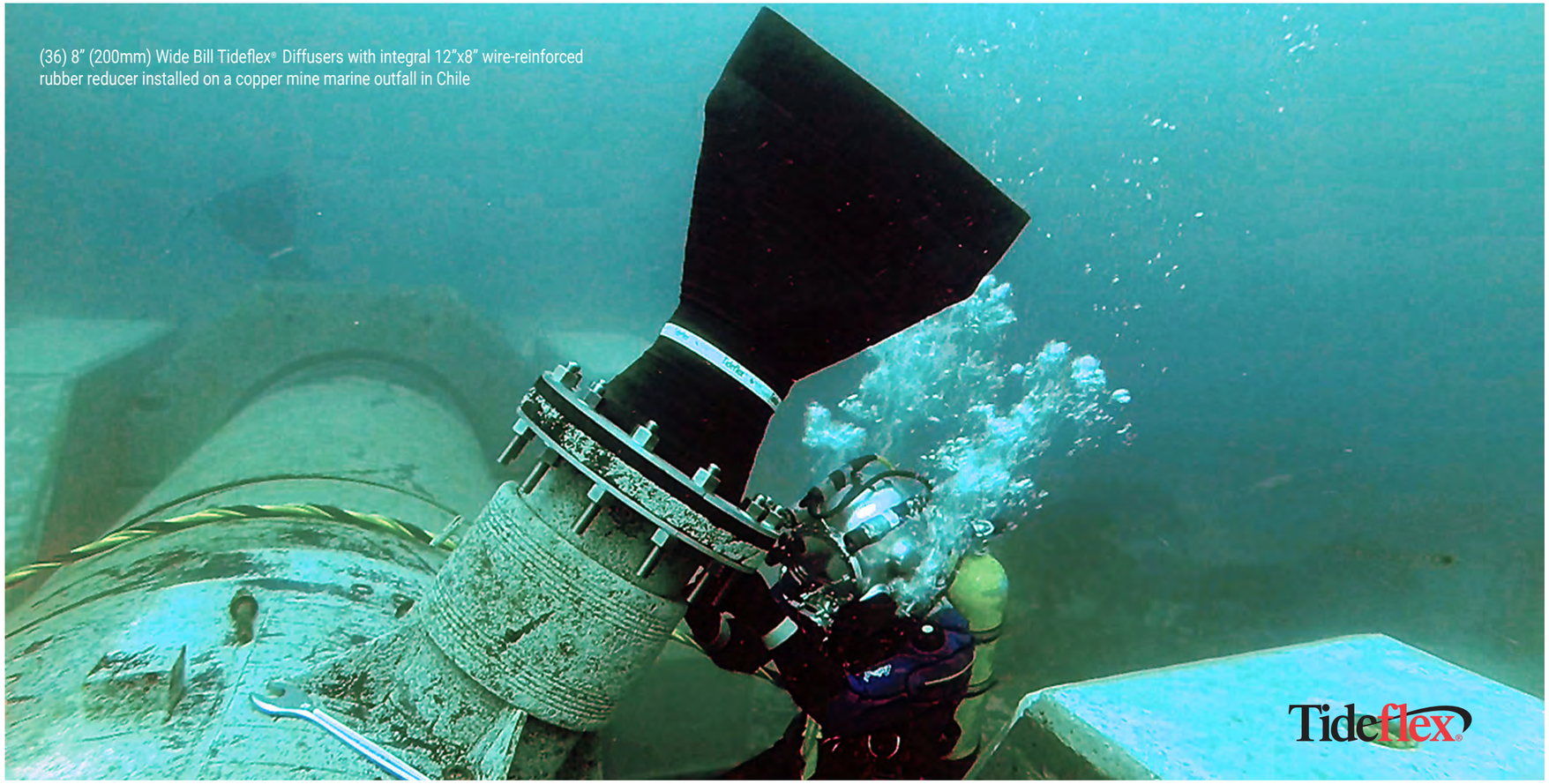


(36) 8" (200mm) Wide Bill Tideflex® Diffusers with integral 12"x8" wire-reinforced rubber reducer installed on a copper mine marine outfall in Chile

Specify Tideflex® Diffuser Nozzles for Superior Performance in Effluent Diffuser Applications

Effluent outfalls typically incorporate multiport diffusers that discharge effluent over a wide area through numerous ports, rather than through one large open-ended pipe. Providing a cost-effective means of achieving high initial dilution, multiport diffusers minimize the impact of municipal and industrial discharges on the environment. The most important item on an effluent diffuser system for controlling the hydraulics and initial dilution are the ports. A diffuser system's ports ensure that peak flows can be discharged with a limited amount of driving head and generate high enough jet velocity to yield the required initial dilution.

Limitations of Conventional Multiport Diffusers

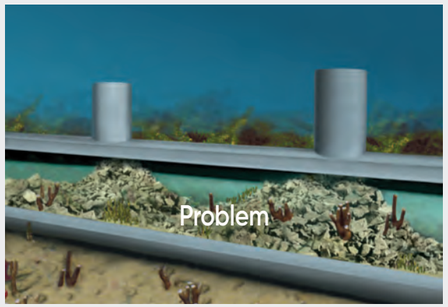
The ports of conventional diffusers are holes cast or drilled into outfall pipe, or risers extending from the crown. These "fixed-orifice" ports cannot prevent the intrusion of sand, mud, debris and saltwater into the diffuser pipe. Sediment enters the diffuser pipe, reducing the hydraulic capacity of the outfall, leading to a need for additional pumping operations or causing overflows to bypass outfalls. If the ports become blocked, even partially, by accumulating sediment, the diffuser operates at a reduced dilution efficiency, creating a risk for permit non-compliance and higher bacterial or constituent concentrations on the shore.

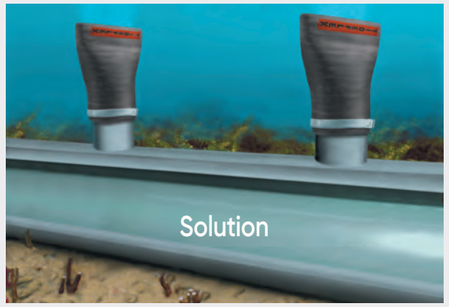
Tideflex® Diffuser Nozzles

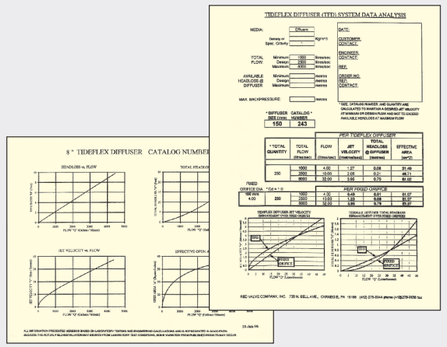
Tideflex® Nozzles operate solely on differential pressure. They are non-mechanical and feature an all-rubber, fabric-reinforced construction that will not corrode and remains unaffected by marine growth. Tideflex® Diffuser Nozzles have revolutionized effluent technology for marine and inland outfall lines in municipal and industrial applications.

Features and Benefits:

- Backflow prevention (sand, silt, saltwater)
- Variable orifice optimizes jet velocity at lower flows which improves initial dilution
- Variable orifice provides more uniform port discharge distribution
- Elliptically-shaped jet yields substantially higher initial dilution versus circular jets
- Makes results from Mixing Zone Models conservative
- Saltwater purging of marine outfalls occurs at extremely low flow rates – no steady state circulation
- Integral rubber risers and elbows prevent damage







Red Valve engineers provide custom sizing of Tideflex® Nozzles for your diffuser design, along with hydraulic analyses containing headloss, jet velocity and effective diameter data.

The Science Behind the Systems: More than 50 Years of Expertise

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(48) 8" (200mm) Tideflex® Diffusers installed on municipal wastewater plant outfall to a river

Rely on Red Valve for Engineering Expertise

Each diffuser system is unique. Red Valve has conducted extensive hydraulic tests on Tideflex® Diffuser Nozzles from 2" (50 mm) to 48" (1200 mm) and has developed an exclusive computer model that Red Valve engineers run to assist in the design of multiport diffusers. The model output includes data and graphs of headloss, total headloss, jet velocity and effective diameter. This data is compared to conventional fixed-diameter orifices to illustrate the hydraulic advantages of Tideflex® Nozzles. For a Diffuser Nozzle Hydraulic Analysis, please contact our engineering department.

Mixing Zone Models Ensure Efficiency

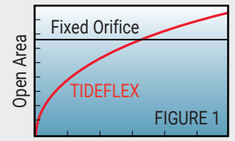
Derived from Red Valve's model, Tideflex® Diffuser hydraulic output data can be input into any Mixing Zone Model, including CORMIX, Visual Plumes and CFD, for near field and far field dilution modeling.

Red Valve engineers partnered with MIXZON, Inc., developers of CORMIX, to incorporate the hydraulic characteristics of various conventional and Wide Bill Tideflex® Diffusers into the CorHyd module of CORMIX.

Effluent Discharge Applications:

- Municipal Inland and Marine
- Pulp and Paper Mills
- Textile Mills
- Chemical Plants
- Dye Plants
- Food Processing Plants
- Power Plants

Variable Area



As well as preventing intrusion, backflow and system clogging, Tideflex® Diffuser Nozzles also enhance hydraulics of multiport diffusers. Unlike fixed-diameter ports, where the open area is constant, Tideflex® Diffuser Nozzles are inherently variable orifice in design. As Figure 1 indicates, the open area increases as flow increases, and decreases as flow decreases.

Reduced Headloss

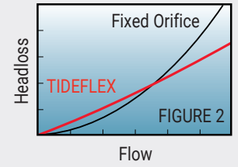
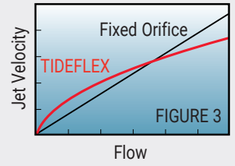


Figure 2 compares the headloss between a fixed-diameter port and a Tideflex® Diffuser Nozzle. The headloss of a fixed orifice is a function of the flow rate squared. The Tideflex® Diffuser Nozzle's variable orifice generates less headloss at peak flow, increasing peak capacity of the outfall, reducing the number of overflows and minimizing energy costs associated with pumps. Able to meet jet velocity requirements often mandated by environmental agencies, Tideflex® Diffusers still generate an acceptable headloss at peak flow. Sizing fixed-orifice ports to generate a similar jet velocity at low flow typically results in excessive headloss at peak flow.

Enhanced Jet Velocity



In Figure 3, the Tideflex® Diffuser Nozzle's variable orifice maximizes jet velocity (momentum), producing as much as three times the jet velocity of fixed orifices at low flow. This is important because jet velocity of flow through each port is key in optimizing dilution.

Elliptical Jet

A major advantage Tideflex® Diffuser Nozzles offer is their elliptical, rather than circular, shape jet. Independent testing in Oregon and Hong Kong proved elliptical geometry provides superior dilution because a receiving water body disperses an elliptical jet much more quickly than a circular jet. This benefit can be especially desirable for diffusers with stringent water quality standards in the near field at the Zone of Initial Dilution (ZID) or other mixing zone boundary.

Outstanding Performance for Municipal and Industrial Applications

Effluent Diffusers that discharge into oceans, estuaries and bays are faced with challenges of strong currents, waves, tides, sediment transport and boat traffic. These conditions can result in intrusion of sediment and saltwater into the outfall, which reduces hydraulic capacity and dilution efficiency of the diffuser. Evacuating sediment from an outfall and rehabilitating the diffuser pipeline typically costs thousands, or even millions, of dollars for large ocean outfalls. Tideflex® Diffuser Nozzles' all fabric-reinforced, elastomer design prevents intrusion of saltwater, sediment and debris, keeping Effluent Diffuser Systems operating at peak hydraulic capacity and dilution efficiency, allowing all ports to consistently flow.

Tideflex® Diffusers are extensively utilized on dense-jet outfalls such as brine from desalination plants and gypsum from fertilizer plants. The effluent density is greater than seawater and it is negatively buoyant. The jets discharge effluent at an inclined angle, so the effluent reaches terminal rise height and then falls back to the seabed. Even when backflow prevention is not required, Tideflex® Diffusers maximize jet velocity at all flow rates, which maximizes the jet trajectory and increases dilution.

Outfalls that discharge to inland waters such as rivers, streams and lakes, also have problems with intrusion of sediment and debris. Incorporating Tideflex® Diffuser Nozzles on new or existing diffusers prevents backflow and ensures the outfall will operate as designed. Since freshwater effluent typically is the same density as the receiving water body, there is no buoyancy difference to assist in increasing dilution, making jet velocity critical because it alone can optimize initial dilution. Tideflex® Diffuser Nozzles' variable orifice enhances jet velocity through a wide range of flows, improving overall dilution and meeting stringent typical water quality regulatory standards. Tideflex® Diffuser Nozzles have been specifically installed at textile, dye, pulp and paper plants to disperse colored effluent that eliminates unsightly "slicks."

More Than 50 Hydraulic Variations and Configurations

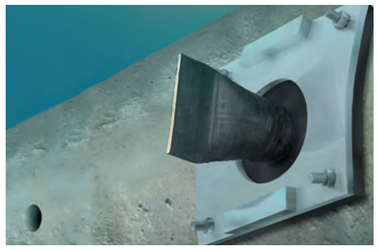
Red Valve can manufacture more than 50 different hydraulic variations of Tideflex® Nozzles per nominal size by changing geometry and relative stiffness. Each one is identified by a reference number called a Hydraulic Code that is provided with our hydraulic analyses. For each project, Red Valve engineers determine the quantity, nominal size, geometry and stiffness of Tideflex® Diffusers required to produce optimized jet velocity, headloss and effective diameter characteristics.

Different geometry variations within the same Tideflex® Diffuser size

Different relative stiffness variations within the same Tideflex® Diffuser size

Marine Outfall

Inland Outfall



Retrofitted 4" square-flanged Tideflex® Diffusers to OD of RCP outfall with fixed-diameter ports

Tideflex® Multiport Diffuser Risers achieve dilution while the number of risers required

Engineered Nozzles for Every Effluent Diffuser System

Wide Bill Tideflex® Diffusers

Wide Bill Tideflex® Diffuser Nozzles open up to, and beyond, the nominal port/riser diameter at peak flow, so they have the same or less headloss as the fixed-diameter ports. This allows smaller risers to be used for new outfall designs, which will reduce cost and is especially beneficial for retrofits as there is no need to oversize them because they will not reduce hydraulic capacity. They also produce jets that have a greater width/depth ratio that yields higher initial dilution.

Slip-On, Circular-Flanged, Square-Flanged Connections

Available with slip-on, circular-flanged and square-flanged connections, Tideflex® Diffuser Nozzles can accommodate any effluent diffuser system. Slip-on nozzles are clamped and pinned to the outside diameter of riser pipes. Circular-flanged nozzles are fastened to any flange, including ANSI, DIN and special flange drillings. Four-hole square-flanged nozzles are fastened directly to the outside diameter of an outfall pipe. Common for outfalls that rest on the riverbed or seabed unburied, square-flanged nozzles have a four-hole arrangement that minimizes localized stress and makes installation easier.

Wire-Reinforced Rubber Risers, Elbows, Tees, Crosses

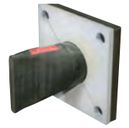
Traditional metal or plastic risers incorporated into buried diffusers are often sheared from the outfall when impacting by debris, anchors, nets, etc., allowing considerable amounts of riverbed or seabed bottom material to backflow into the outfall, which reduces hydraulic capacity and compromises dilution. Flexible and durable Tideflex® Nozzles are fabricated with integral wire-reinforced rubber elbows, risers, tees and crosses that deflect and return when impacted by debris, eliminating physical damage to the diffuser. Integral elbows can be manufactured at any angle between 5 to 90 degrees.

Tideflex® Diffusers discharge at an inclined angle to maximize dilution for dense jet brine outfalls from desalination plants

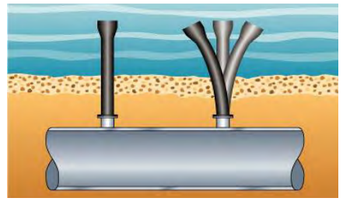
Wide Bill Tideflex® Diffusers

Slip-On

Circular-Flanged



Square-Flanged



Tideflex® Diffuser Nozzles' wire-reinforced rubber risers and elbows help eliminate breakage

48" Tideflex® Diffuser with integral 60"x48" wire-reinforced rubber elbow

Integral 45° Elbow

Integral Rubber Riser

Multiport Diffuser

Red Valve offers a worldwide, world-class custom service network. With corporate offices in Pittsburgh, PA, manufacturing facilities in Gastonia, NC, and 114 sales representatives in 61 countries around the globe, Red Valve has the sales engineering team to help you select the best choice of valves and related products for your applications.

Represented by:

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