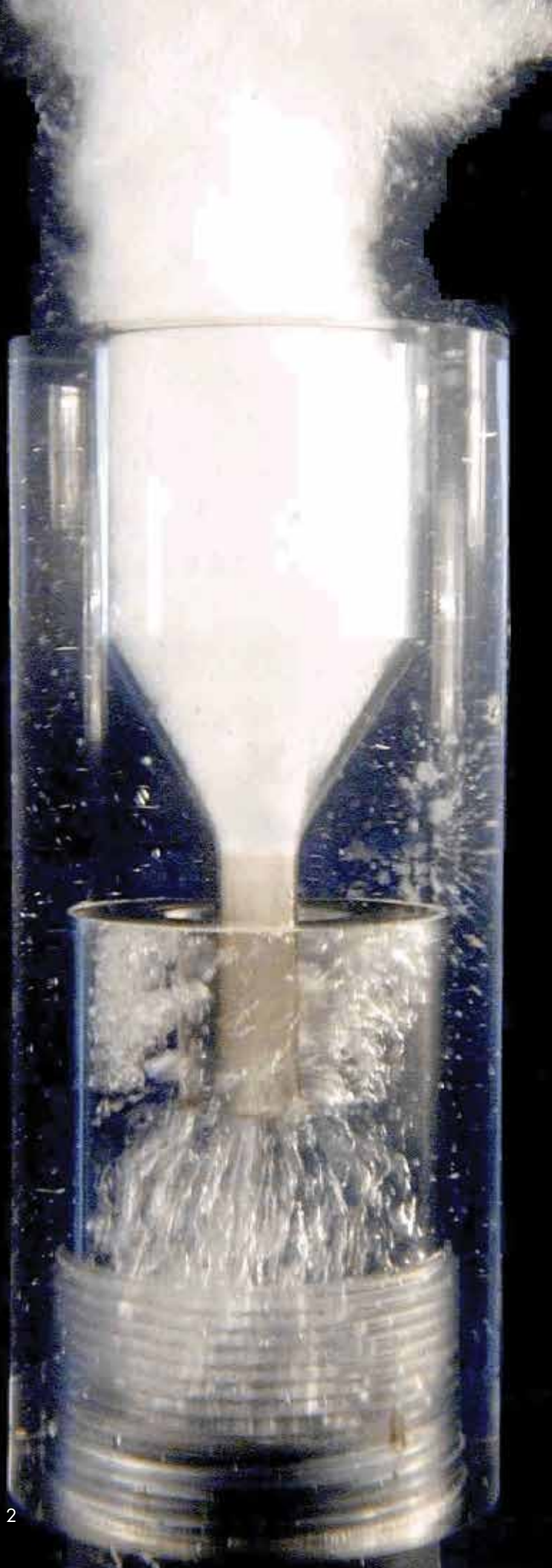


ERIEZ

FLOTATION DIVISION



● CAVITATION TUBE SPARGING SYSTEMS ●



CAVTUBE SPARGERS

Generate picobubbles to substantially improve flotation kinetics and increase recovery of ultrafines particles.

Cavitation Tube spargers are the heart of the patented bubble generation technique used in EFD column flotation cells. The specially designed “CavTubes” are an integral part of the hydrodynamic aeration system used to maximize fine bubble generation and improve bubble-particle collision rates.

CavTubes can also be used as part of a pre-aeration system that can be applied independently in a flotation feed line to increase the recovery of overloaded circuits or improve the flotation response of “hard-to-float” material.

Applications include:

- Aeration of Column Flotation Cells
- Pre-Aeration Systems

◀ An acrylic model of an Eriez CPT Cavitation Tube showing the generation of picobubbles.

▶ Typical installation of the CavTube hydrodynamic spargers for recovery of fine potash.

CAVITATION TUBE SPARGING

The CavTube design is based on the principle of hydrodynamic cavitation. This occurs when the pressure in a moving liquid is momentarily reduced below its vapor pressure, creating ultra-fine air or vapor-filled bubbles. These fine bubbles are carried by the flow to a region of higher pressure resulting in a bubble dispersion that resembles fine smoke.

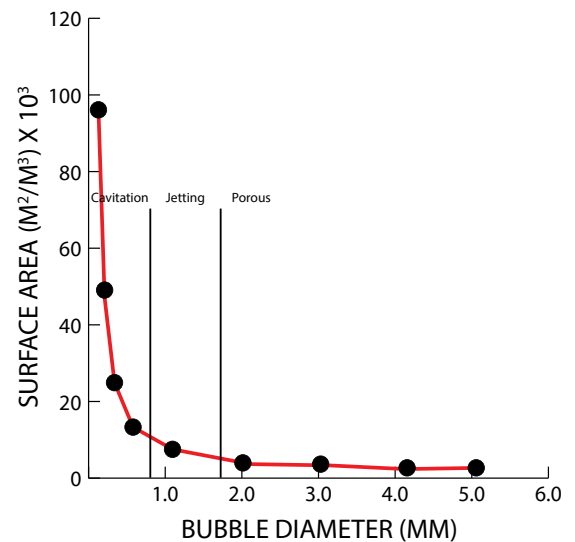
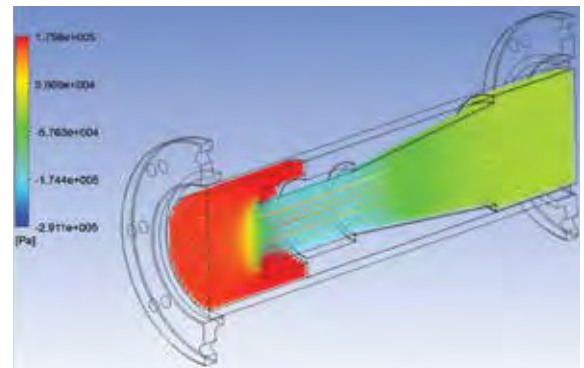
Cavitation and the shearing of additional gas ensures generation of fine bubbles suitable for recovery of both ultra-fine and coarse particles.

CavTubes are offered in a variety of materials of construction to provide a long wear life. Material selection is based on application specifics and includes polyurethane, ceramic, tungsten carbide and hardened steel.

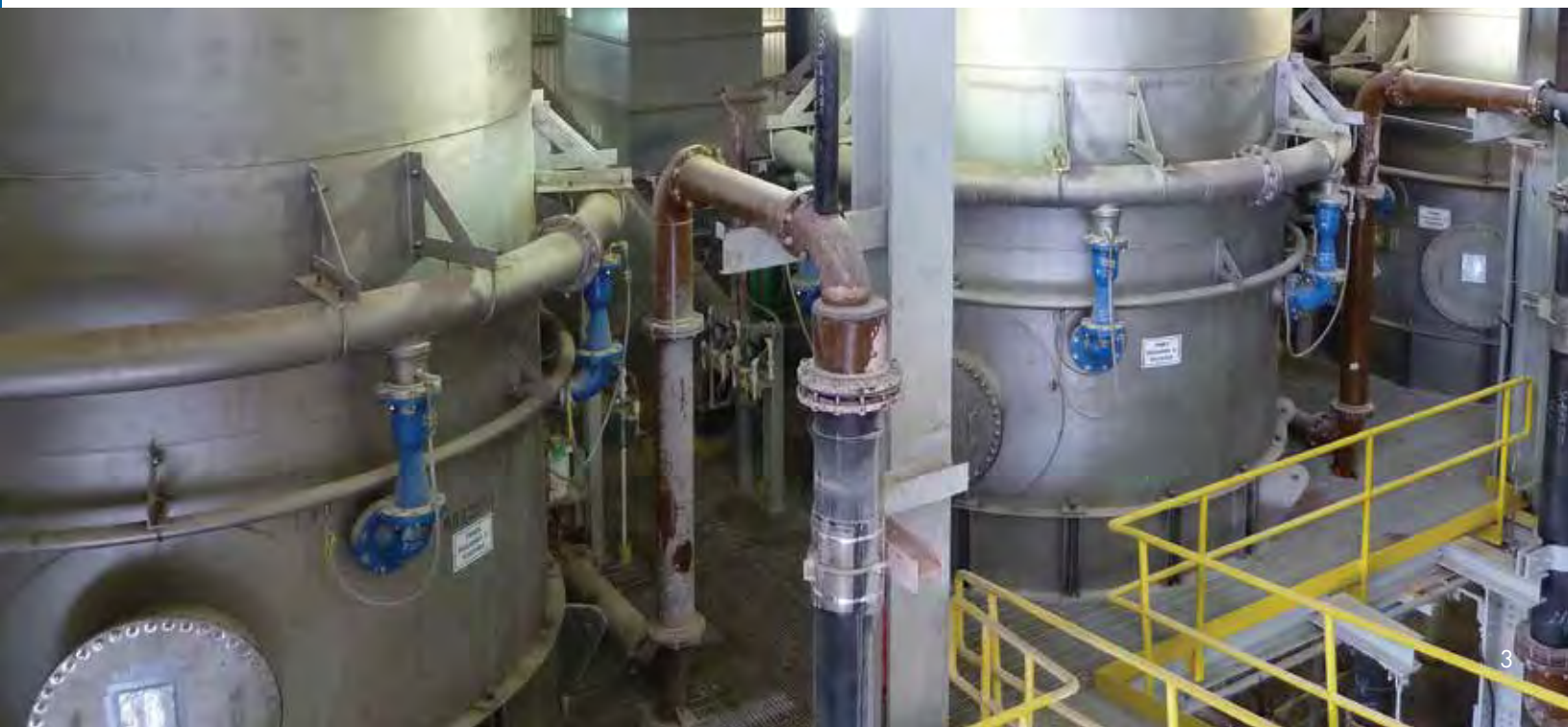
Cavitation Tubes:

- Ensure a higher attachment probability... higher recovery of hydrophobic particles.
- Improve bubble/particle collision rates... lower reagent costs.
- There are no impinging parts in the flow path leading to longer wear life which has been confirmed by customer plant trials.

Pressure vs. Flow Analysis



This chart shows the relationship between bubble diameter and the generation of surface area indicating that superficial bubble surface area rate (i.e., capacity) is maximized when using hydrodynamic cavitation.



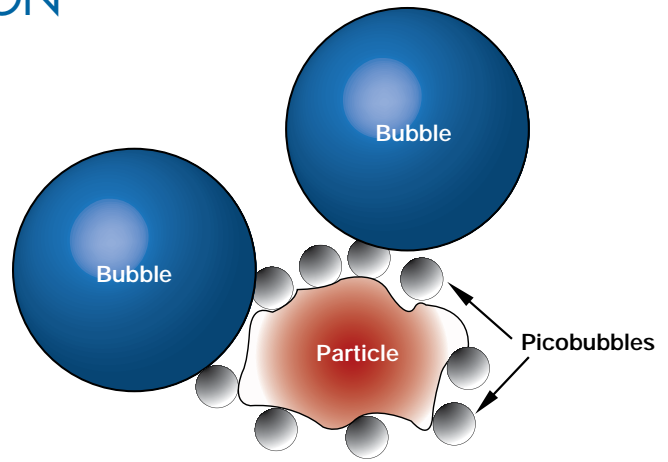
PICOBUBBLE ENHANCED FLOTATION

Ultra fine bubbles naturally exist in liquids and can be created through dynamic cavitation. These picobubbles readily attach to hydrophobic particles due to improved hydrodynamics and free-energy conditions.

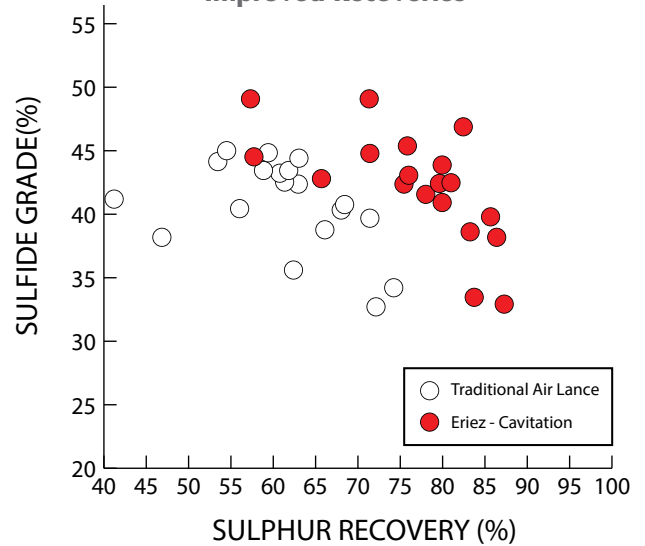
Combining cavitation-induced bubble generation with mechanically generated bubbles produces higher flotation recoveries than by either method alone. This synergistic effect is caused by the nucleation of picobubbles on the particle surface.

Picobubbles improve the flotation response by acting as a secondary "collector," enhancing the bubble-particle attachment probability and reducing detachment.

Cavitation-Tube sparging systems have been demonstrated on an industrial scale in coal, base metals, sulfides and non-metallic applications. These installations have yielded improvements in recovery, reagent consumption and wear.



Improved Recoveries

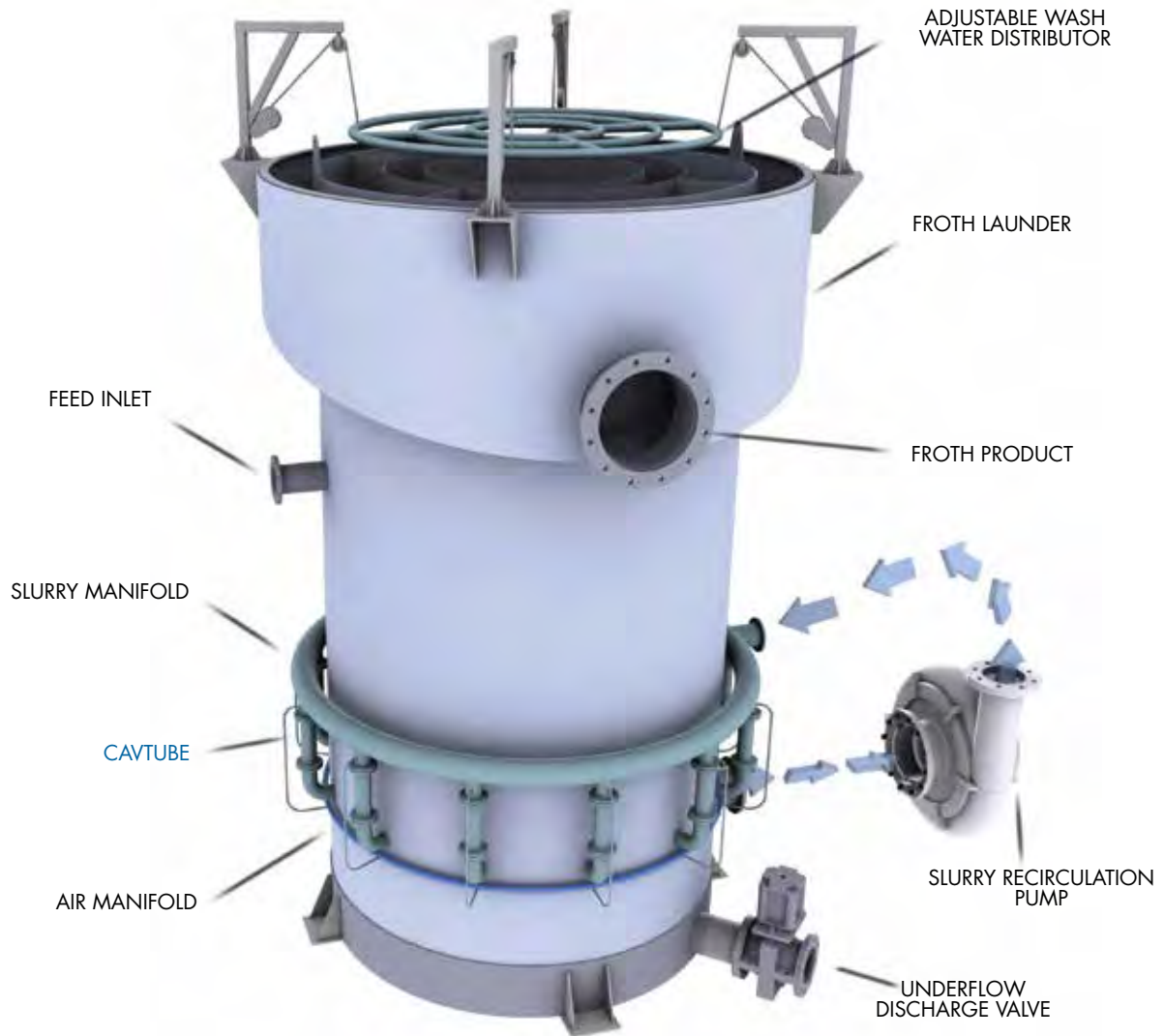


Improvement in sulfide recovery using the Cavitation-Tube sparging system when treating -50 micron fines.



Fine, stable froth generated using Cavitation-Tube Sparging System.

TYPICAL ARRANGEMENT: CAVITATION TUBE SPARGING



Eriez' Cavitation Tube systems consist of a centrifugal recycle pump, a slurry distribution manifold and a series of spargers designed to induce cavitation and generate fine bubbles. In operation, a portion of underflow slurry is drawn from the column and pumped to a distribution manifold where it is divided equally between the CavTube spargers. Process air is injected under pressure at the inlet of the cavitation tube to provide additional air for flotation. The two-phase mixture passes through the CavTube sparger and is reinjected into the bottom of the column cell with the air dispersed as fine bubbles.

For more information, visit www.eriezflotation.com

EFD Column cell with CavTubes installed for ultra-fine niobium recovery (20x5 micron).



PRE-AERATION SYSTEM

Flotation circuit performance can be improved by integrating the CavTube technology with the EFD feed pre-aeration system, the *Feed Air Jet*.

This performance improvement is a result of pre-aerating slurry in the feed stream, where the concentration of floatable material is highest.

This approach can be applied independently to circuit feed lines to improve the kinetics and capacity of overloaded flotation cells in addition to improving the recovery of "hard-to-float" material.

Numerous scientific papers and studies are available to show that pre-aeration improves unit performance by starting the bubble-particle collection in the feed stream.



▲ Feed Air Jet Pre-Aeration System

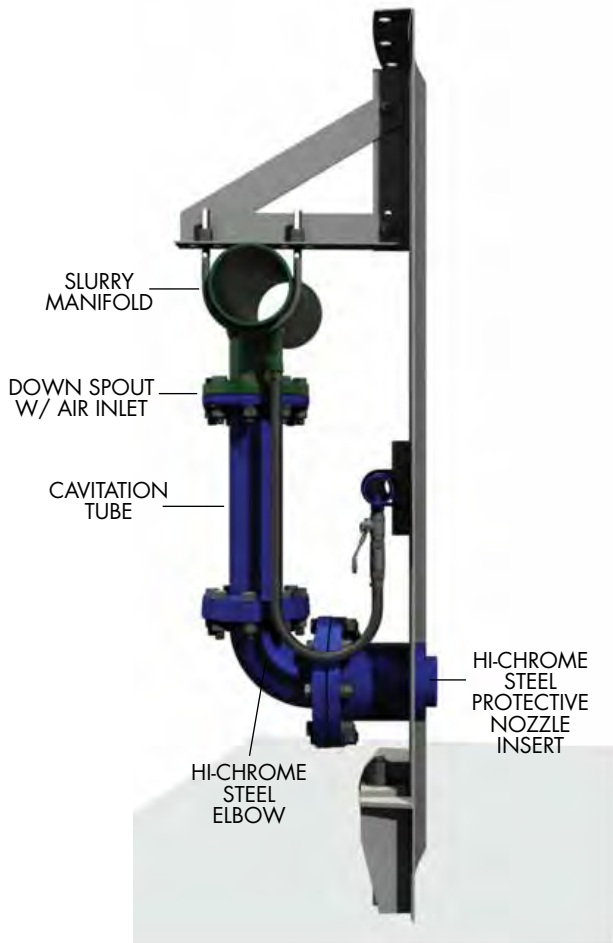
RETROFIT INSTALLATIONS

CavTube spargers, unlike static mixers, do not use "wear-prone" internal components. The slurry is forced through an orifice instead of around internal mixing vanes. As a result, customers have been able to retrofit CavTubes into existing column circuits providing both improved metallurgy and maintenance. CavTubes can also be used to replace older style air-lance systems to gain additional recovery in ultra-fine applications.

Phosphate industry user stated,
"...we replaced inline static mixers with Eriez' CavTubes and the recoveries are better, wear is negligible..."



CAVITATION TUBE SPECIFICATIONS



SERIES	CONNECTION TYPE	TYPICAL GAS FLOW RATE (FREE AIR DELIVERY)		TYPICAL MATERIALS OF CONSTRUCTION
		CFM	M3/HR	
CT 100	FNPT	0.4 - 0.5	0.7 - 0.8	316SS Tungsten Carbide
CT 200P	2" FF	7.6 - 8.8	13.0 - 15.0	Polyurethane/Ceramic
CT 400P	4" FF	28 - 32	48 - 55	Polyurethane/Ceramic
CT 400	4" FF	31 - 35	52 - 60	Hi-Chrome Steel
CT 600	6" FF	41 - 47	70 - 80	Hi-Chrome Steel

**Please note materials of construction will be based on application specifics.*



Flotation



Hydraulic Separation



Lab & Pilot Equipment, Testing and Technical Service

WORLD AUTHORITY IN ADVANCED SEPARATION TECHNOLOGIES

Customer-Focused Service Spanning the World of Minerals

The Eriez Flotation Division (EFD) is focused on addressing specialty flotation applications through innovative technology and expert support.

EFD is committed to providing state-of-the-art equipment and process solutions for new and existing projects worldwide. We understand and quickly respond to the needs of our clients. Our versatility is demonstrated by the diversity of our engineering services and the varying sizes of projects we have successfully completed around the world.

Our state-of-the-art test lab and pilot facilities in Erie, PA are available to demonstrate and pilot solutions based on your unique needs.

Contact the nearest Eriez Flotation Division office for technical support or design engineering to suit your specific application.



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Website: www.eriezflotation.com

