

Thank You for Attending Our January Webinar:

Using Eductors in Non-Powered Tank Mixing and Pumping



Your Host

Mike DeLacluyse
President
Lesman Instrument Co
miked@lesman.com



Featured Speaker

Clarence Dela Vega
Eductor Sales Specialist
Clark-Reliance
cdelavega@clark-reliance.com



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Jacoby-Tarbox® Eductors™

Anderson Separators® Clark Steam Traps™ Ernst Flow Industries® Enervac™ HYCOA® Jacoby-Tarbox®
Jerguson® Magne-Sonics® National Filtration Systems® Oil Filtration Systems® Reliance® Boiler Trim™

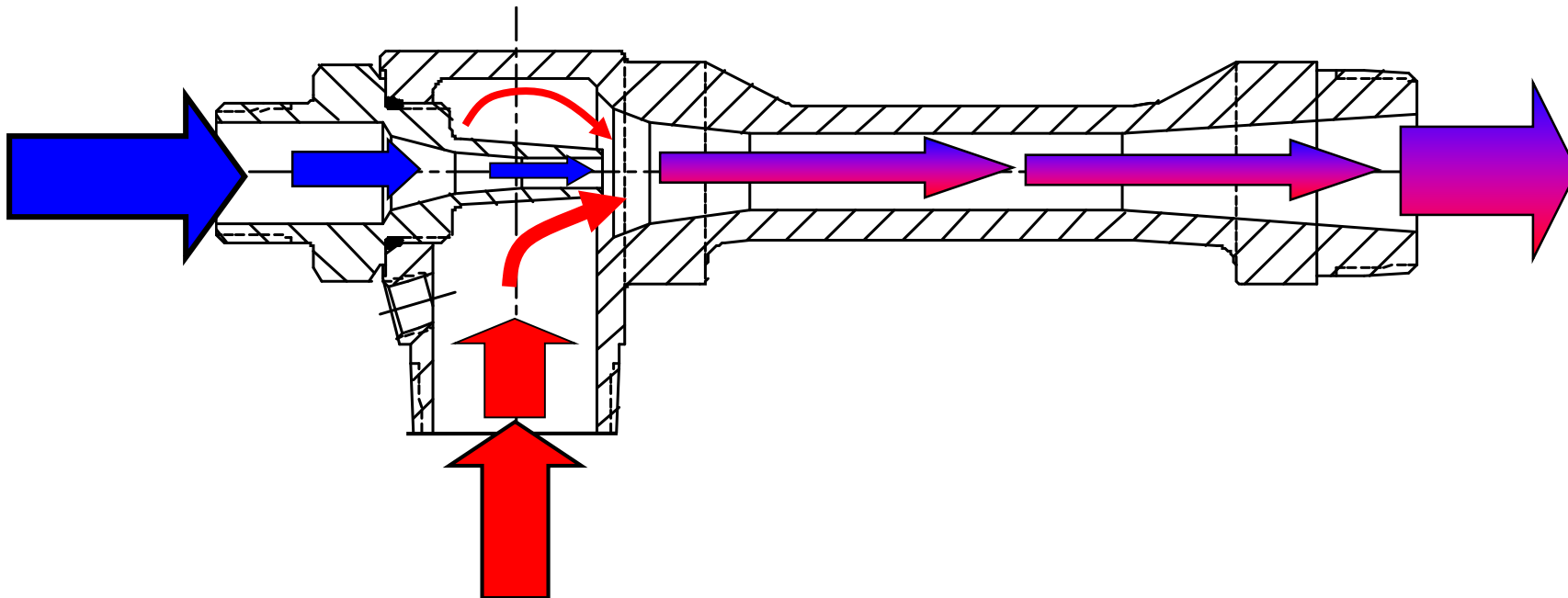
JACOBY-TARBOX[®]



What is an “Eductor” ?

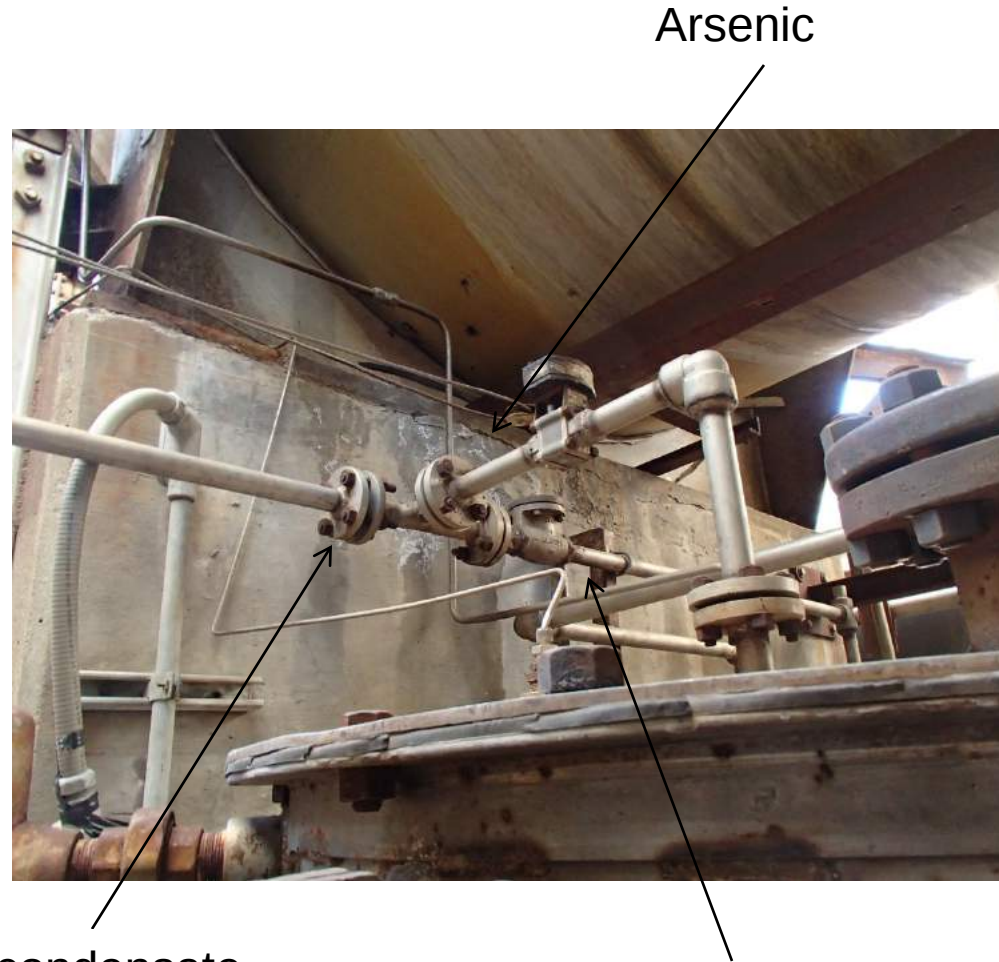
A device that uses kinetic energy from one fluid (motive) to create a pressure differential in a confined space. This pressure differential allows a secondary fluid (suction) to flow toward this lower pressure area.

Either “fluid” may be a liquid, gas, or steam.



Eductor Applications

- Steam heating
- Liquid mixing
- Dilution
- Solids transfer
- Pump priming
- Gas mixing
- Venting gas



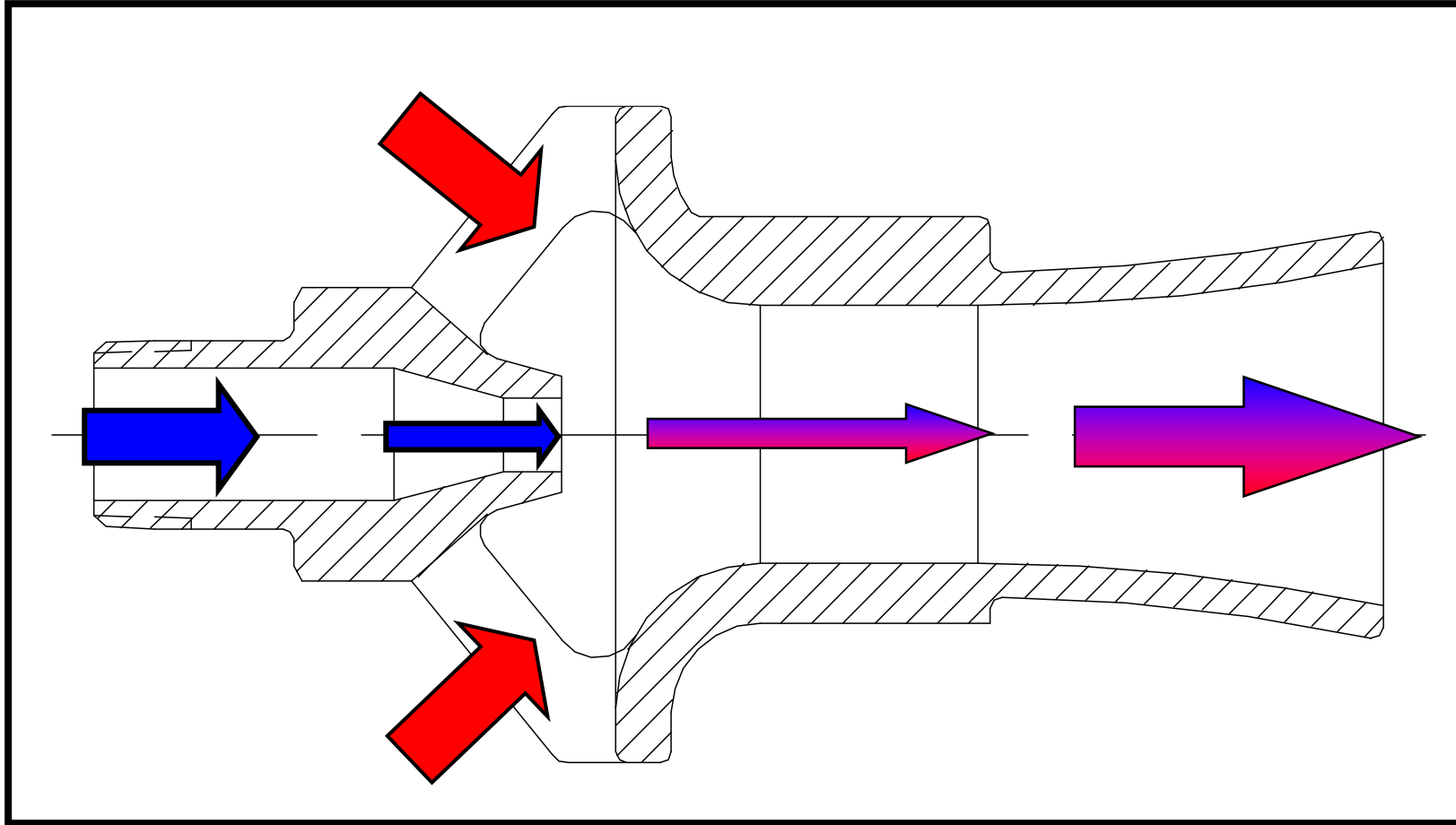
In-Line Eductor Applications (Specifics)

- **Diesel pumping sulfuric acid (refineries)**
- **Water pumping wet strength resin (paper mills)**
- **Water pumping liquid detergent (fire applications)**
- **Water pumping activated carbon or anthracite (water treatment)**
- **Water pumping acids and bases (pH balance, water treatment)**
- **Water pumping bilge water (government, Navy)**
- **Steam pumping sulfur: gasoline desulfurization (refineries)**
- **Air entraining flue gas (sewage facilities)**

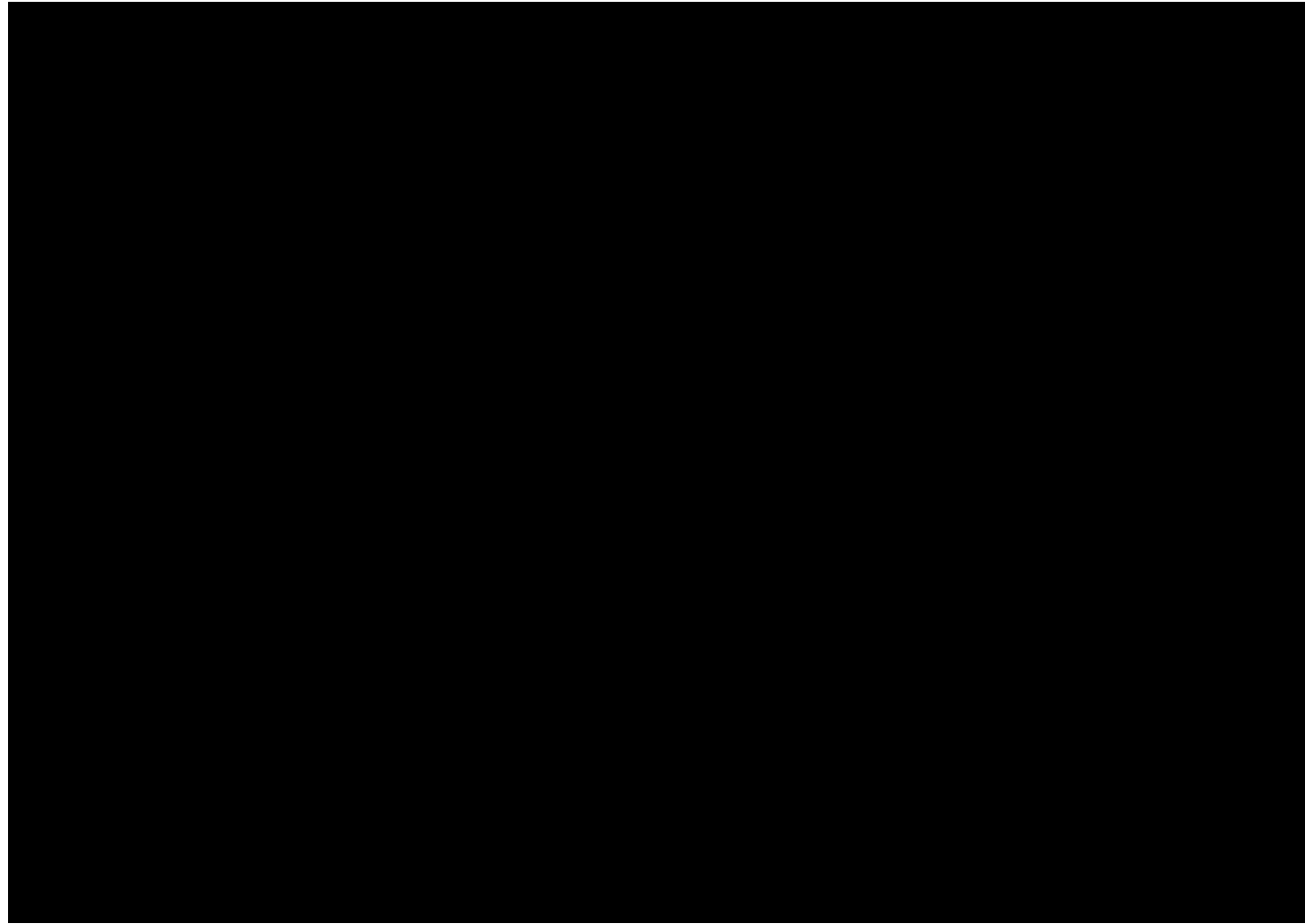
In-Line Eductor Applications (Specifics) cont:

- **Steam heating sugar juice (sugar cane facilities)**
- **Direct steam injection heating hydrocarbons (refineries)**
- **Steam sterilization (government)**
- **Refrigerant pumping refrigerant in closed loop systems
(new technology: pending patent approval)**
- **Pumping water from a sump (water treatment)**
- **Natural gas pumping natural gas liquid (skid projects)**
- **Water condensate pumping arsenic solution (refineries)**
- **Pumping liquid propane offshore (refineries)**

TLA (Tank Liquid Agitator)

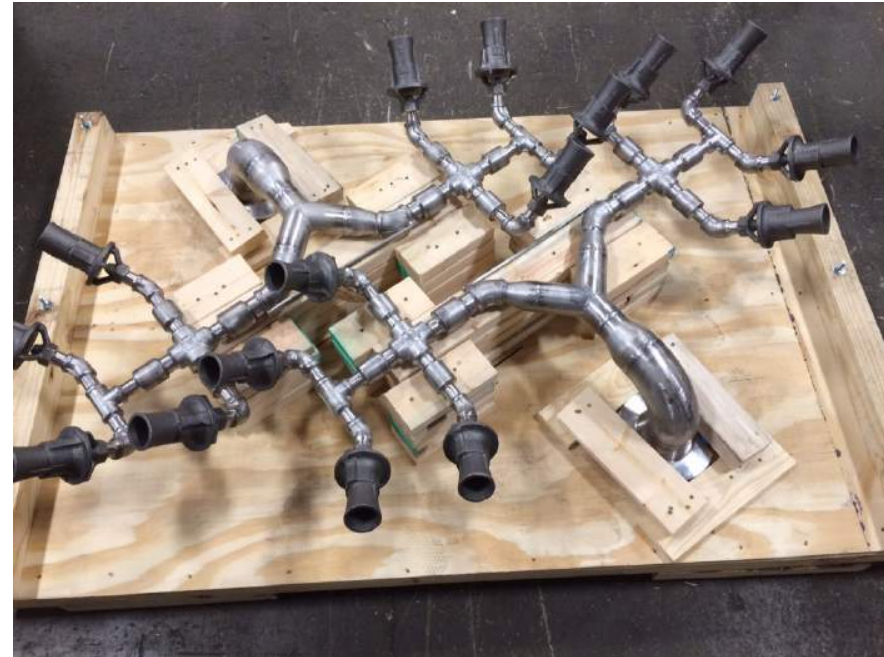


TLA (Tank Liquid Agitator)

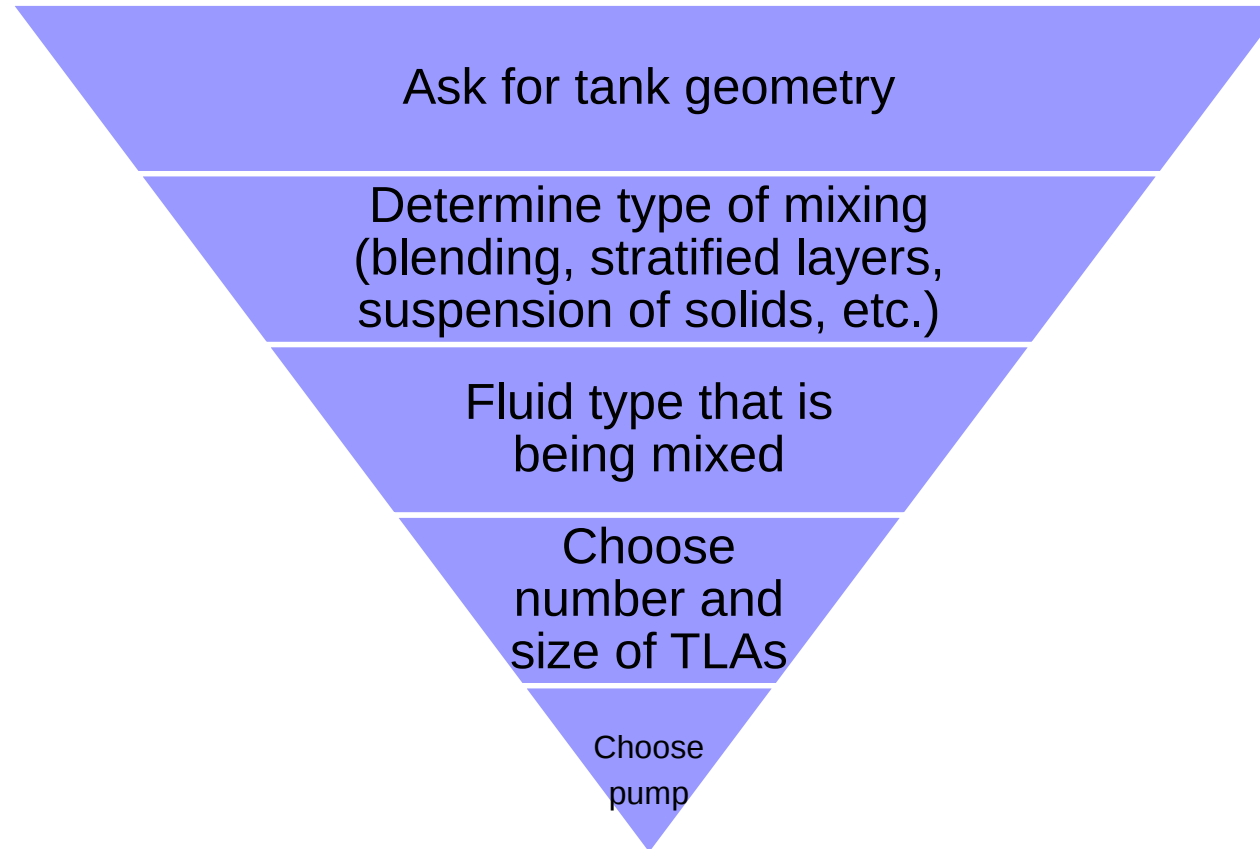


TLA Applications

- Chemical blending
- Chemical neutralization
- Steam tank heating
- Solids suspension
- Blending crude oil

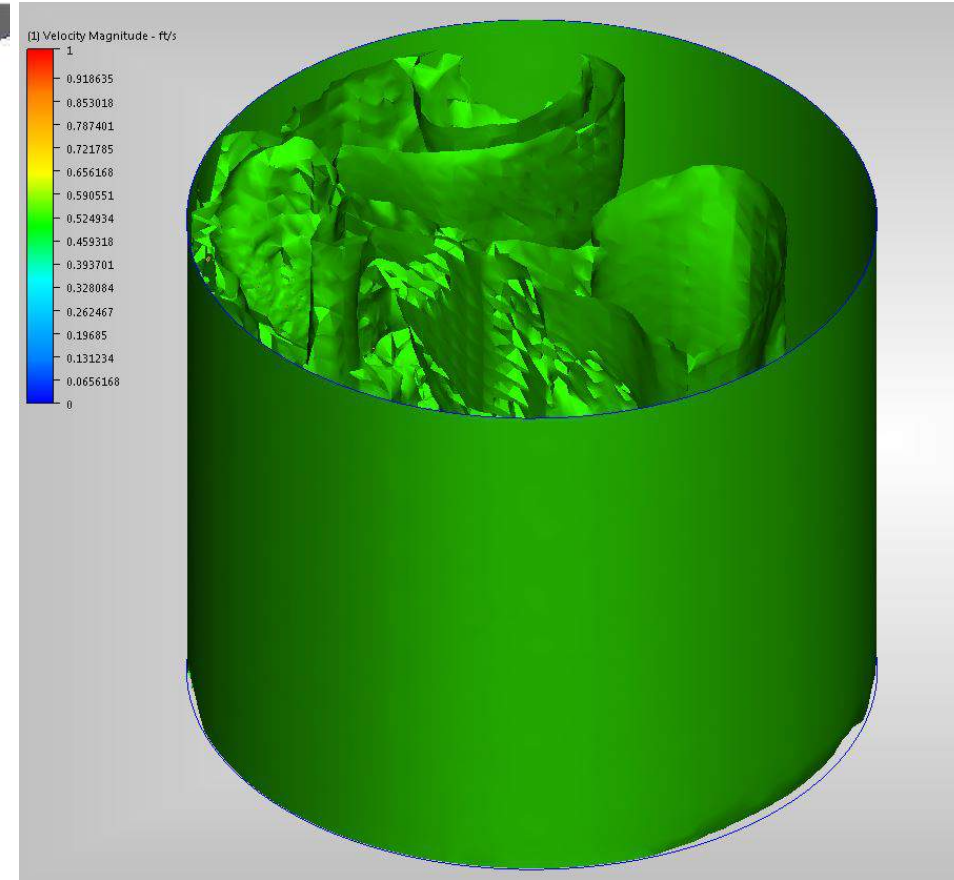


TLA Application - Sequence



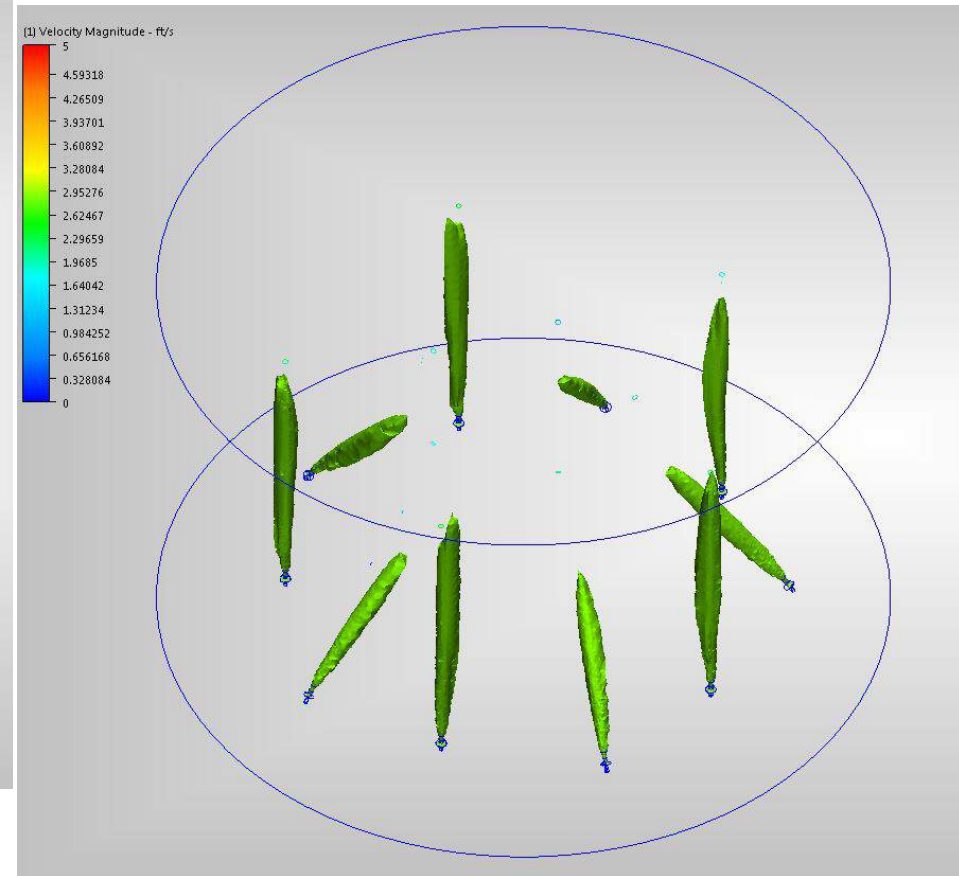
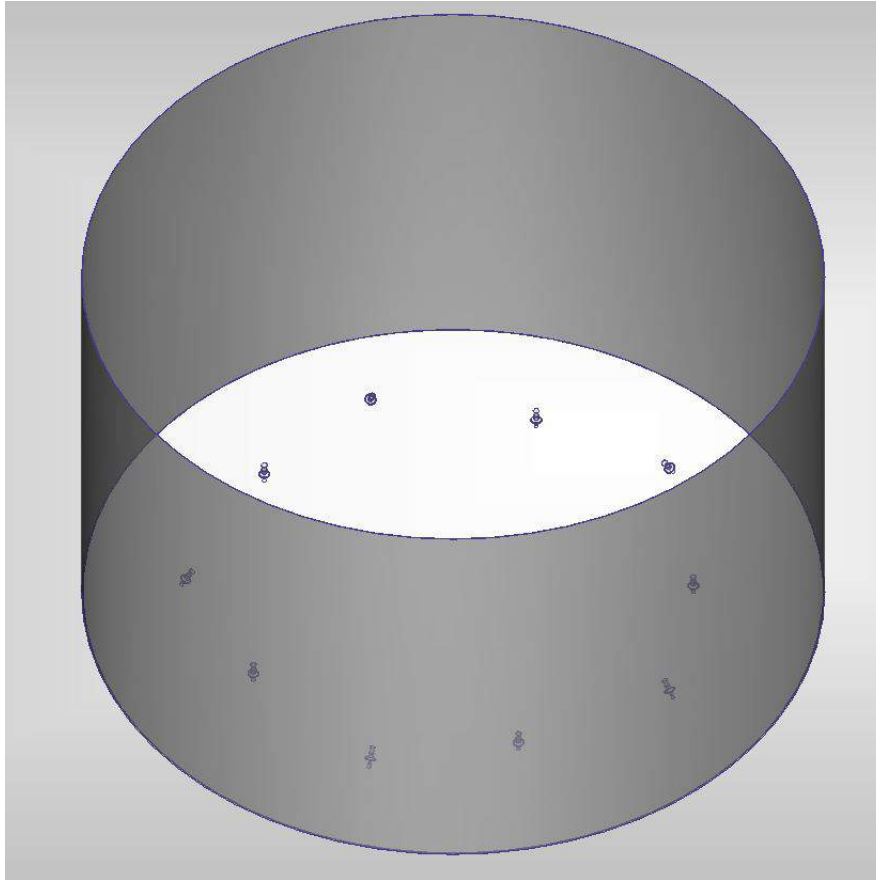
TLA Application - Types

General Mixing:



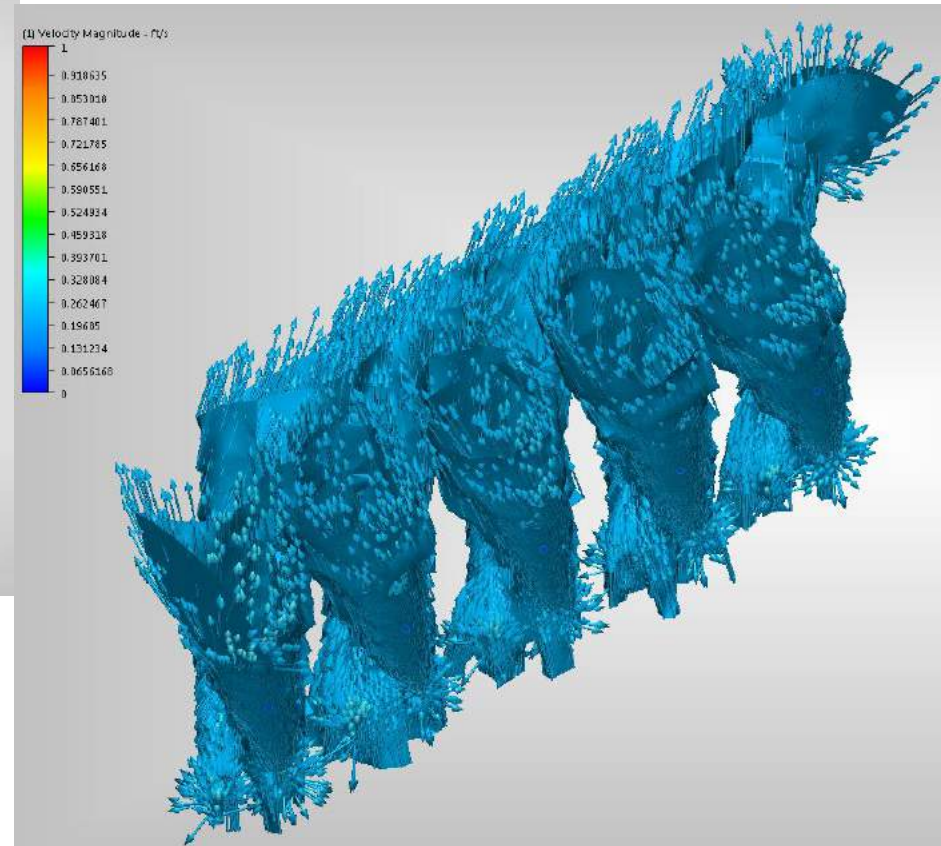
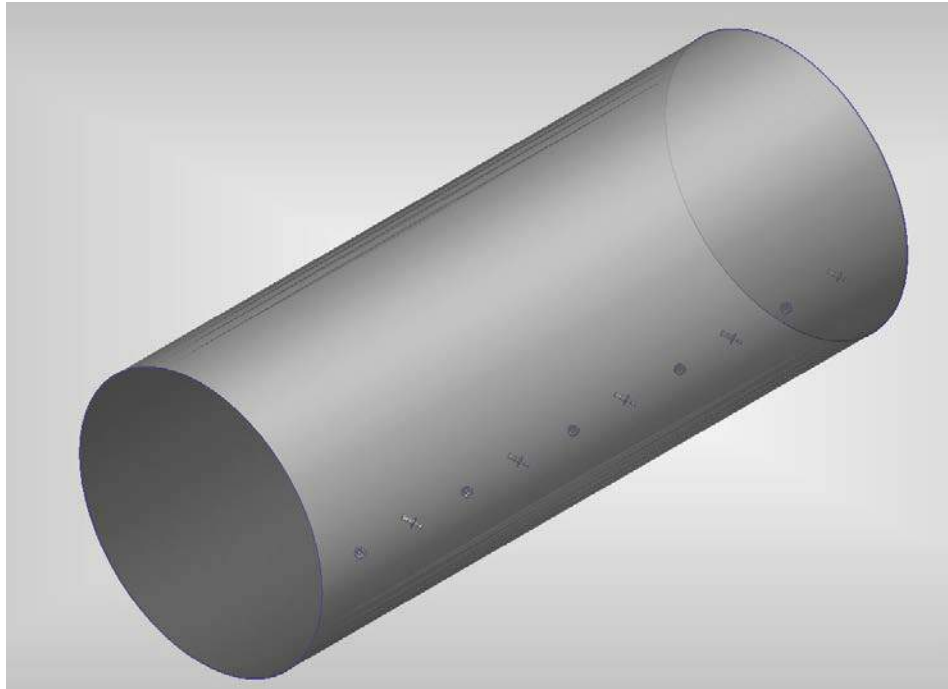
TLA Application - Types

Stratified Layers:



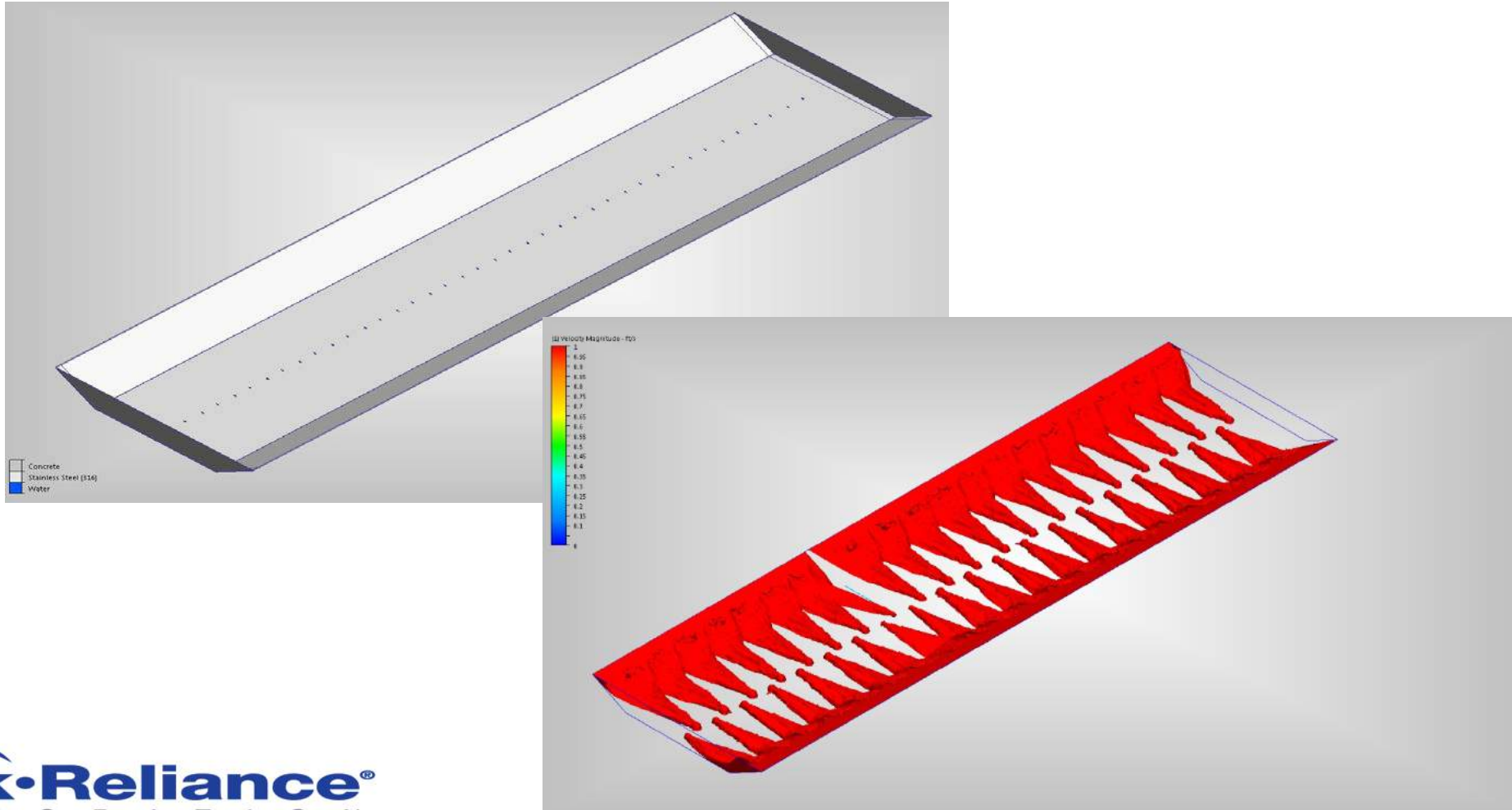
TLA Application - Types

Suspension of Solids:

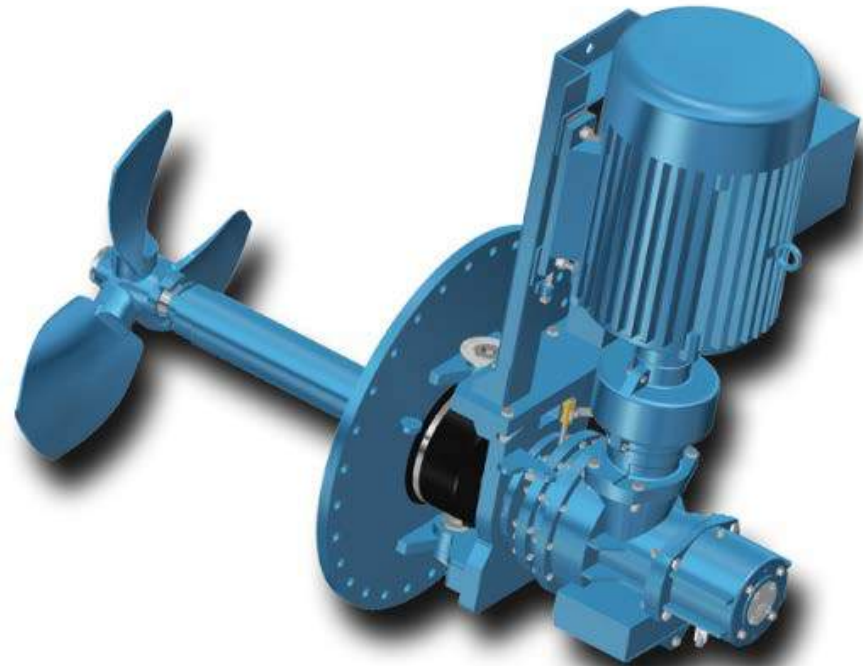
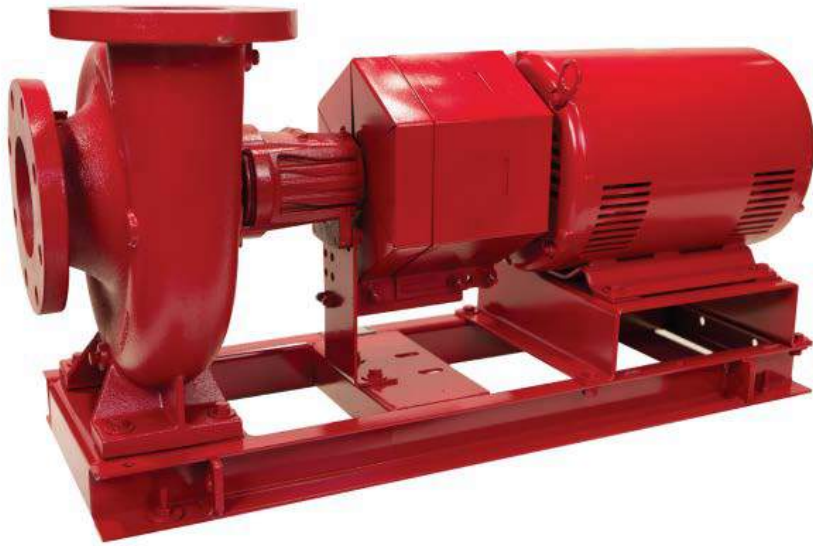


TLA Application - Types

Directional Sweep:



Cost Savings: Pump vs. Mechanical Mixer



Jensen Mechanical Mixer

Model	Model 620	Model 650	Model 680
Horsepower (Max.)	20	40	75
Shaft R.P.M.	425	425	425
Gear Rating*	37.5 HP	116 HP	116 HP
Bearing Life **	48,000 HRS.	64,000 HRS.	48,000 HRS.
Critical Speed ***	2,470 RPM	2,800 RPM	3,200 RPM

* Equivalent A.G.M.A Class II Horsepower

** B-10 Life (90% of the bearings will meet or exceed). Life shown is lowest calculated life of any bearing in the mixer.

*** Propeller shaft first critical speed.

Select hp unit type: Mechanic horsepower ▾

Enter horsepower: hp

Convert Reset

Result in kilowatts: 14.91399744 kW

Jensen Mechanical Mixer: Model 620

Electricity Bill Calculator

Electricity bill cost calculator. Electricity usage consumption calculator.

Select country:	United States	▼
Typical appliance:	-- select --	▼
Power consumption:	14.91	kilowatts (kW)
Hours of use per day:	24	h/day
1 kilowatt-hour (kWh) cost:	12	cent
	Calculate	Reset
Electricity cost per day:	\$42.9408	
Electricity cost per month:	\$1307.01	
Electricity cost per year:	\$15684.1	

Standard Pump

Useful Pump Formulas

$$\text{Pressure (PSI)} = \frac{\text{Head (Feet)} \times \text{Specific Gravity}}{2.31}$$

$$\text{Head (Feet)} = \frac{\text{Pressure (PSI)} \times 2.31}{\text{Specific Gravity}}$$

$$\text{Vacuum (Inches of Mercury)} = \frac{\text{Dynamic Suction Lift (Feet)} \times .883}{\text{Specific Gravity}}$$

$$\text{Horsepower (Brake)} = \frac{\text{GPM} \times \text{Head (Feet)} \times \text{Specific Gravity}}{3960 \times \text{Pump Efficiency}}$$

$$\text{Horsepower (Water)} = \frac{\text{GPM} \times \text{Head (Feet)} \times \text{Specific Gravity}}{3960}$$

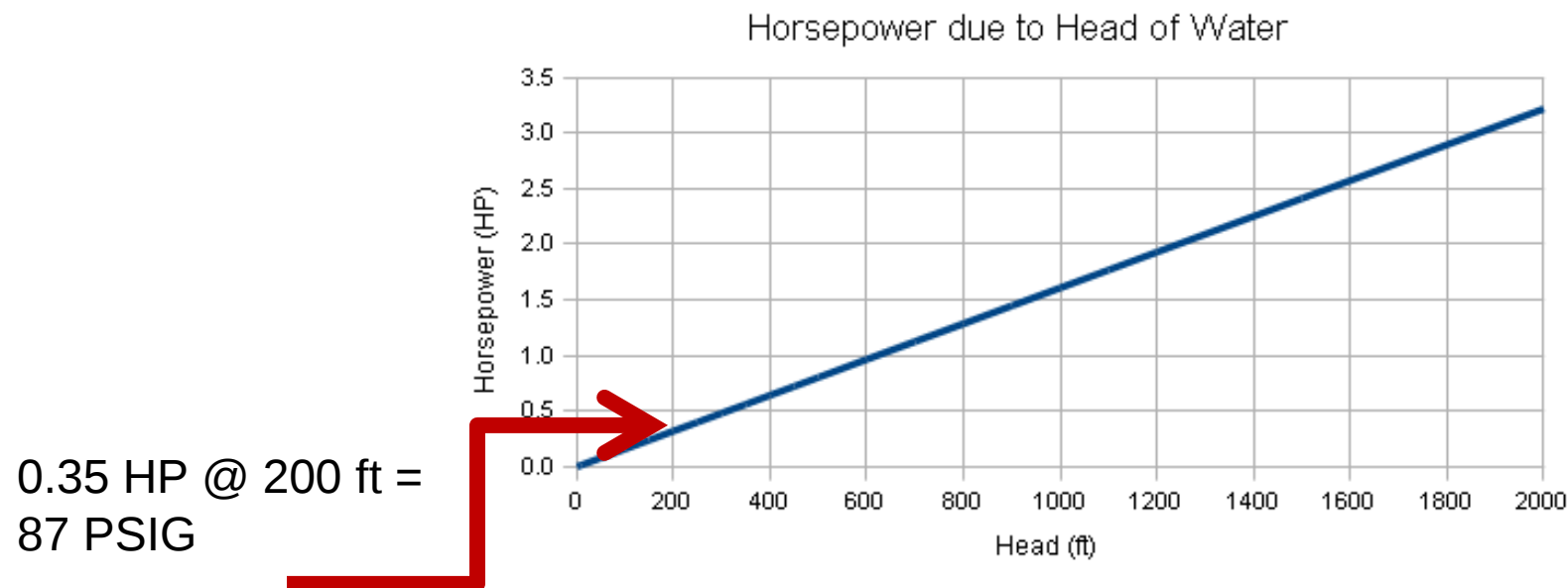
$$\text{Efficiency (Pump)} = \frac{\text{Horsepower (Water)}}{\text{Horsepower (Brake)}} \times 100 \text{ Per Cent}$$

$$\text{NPSH (Available)} = \text{Positive Factors} - \text{Negative Factors}$$

Standard Pump

Power to Pump Water

Required horsepower (*hp*) to pump 1 cubic foot of water per minute (ft^3/min) with efficiency 85% - is indicated in the diagram below:

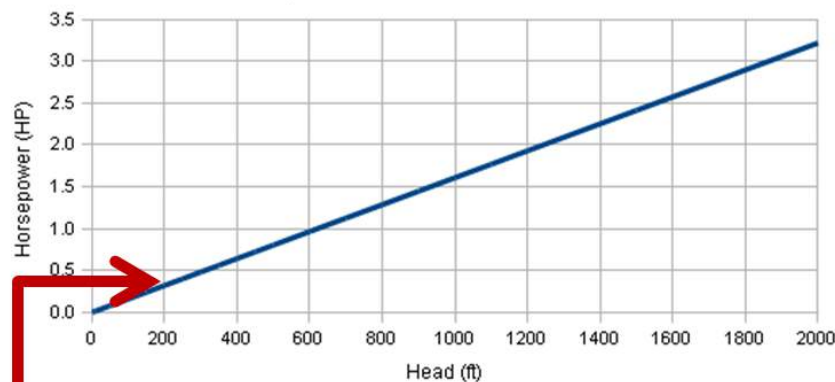


Standard Pump

1 cubic foot of
water per minute =
7.5 GPM

0.35 HP @ 200 ft =
87 PSIG

Horsepower due to Head of Water



2" @ 90 PSIG = 185
GPM required

Size IPS	Sizing Factor		Pressure Difference, PSI											
			10	20	30	40	50	60	70	80	90	100	120	140
3/8	0.23	Inlet Flow	7.1	10.0	12.3	14.2	15.8	17.4	18.7	20.1	21.3	22.4	24.6	26.5
		Outlet Flow	35	50	61	71	79	87	88	90	91	92	94	96
		Max. Length	4	8	12	16	22	29	36	43	50	58	72	86
3/4	0.50	Inlet Flow	15.4	21.8	26.7	30.8	34.5	37.8	40.8	43.6	46.3	48.8	53.4	57.7
		Outlet Flow	77	109	134	154	172	189	192	195	197	200	204	209
		Max. Length	5	11	17	24	33	42	53	64	74	85	106	127
1 1/2	1.00	Inlet Flow	30.8	43.6	53.4	61.6	68.9	75.5	81.5	87.2	92.5	97.5	107	115
		Outlet Flow	154	218	267	306	345	378	384	389	395	400	409	417
		Max. Length	7.5	16	24	34	46	60	75	90	105	120	150	180
2	2.00	Inlet Flow	61.6	87.2	107	123	138	151	163	174	185	195	214	231
		Outlet Flow	308	436	534	616	689	755	767	778	789	799	818	835
		Max. Length	11	23	34	48	65	85	106	127	148	170	212	255
3	4.60	Inlet Flow	142	201	246	283	317	347	375	401	426	449	491	531
		Outlet Flow	708	1,003	1,228	1,417	1,585	1,737	1,764	1,790	1,815	1,836	1,880	1,920
		Max. Length	16	34	51	73	99	129	161	193	225	257	322	386

Standard Pump

$$\frac{0.35 \text{ horsepower}}{7.56 \text{ GPM}} = \frac{x \text{ horsepower}}{185 \text{ GPM}}$$

Select hp unit type: Mechanic horsepower ▾

Enter horsepower: hp

Convert Reset

Result in kilowatts: kW

Electricity Bill Calculator

Electricity bill cost calculator. Electricity usage consumption calculator.

Select country: United States ▾

Typical appliance: -- select -- ▾

Power consumption: kilowatts (kW) ▾

Hours of use per day: h/day

1 kilowatt-hour (kWh) cost: cent ▾

Calculate Reset

Electricity cost per day:

Electricity cost per month:

Electricity cost per year:

Comparing Equipment Costs

Jensen Mixer Model 620

2" TLA w/ recirculation pump

Electricity Bill Calculator

Electricity bill cost calculator. Electricity usage consumption calculator.

Select country:	United States	▼
Typical appliance:	-- select --	▼
Power consumption:	14.91	kilowatts (kW) ▼
Hours of use per day:	24	h/day
1 kilowatt-hour (kWh) cost:	12	cent ▼
Calculate Reset		
Electricity cost per day:	\$42.9408	
Electricity cost per month:	\$1307.01	
Electricity cost per year:	\$15684.1	

Electricity Bill Calculator

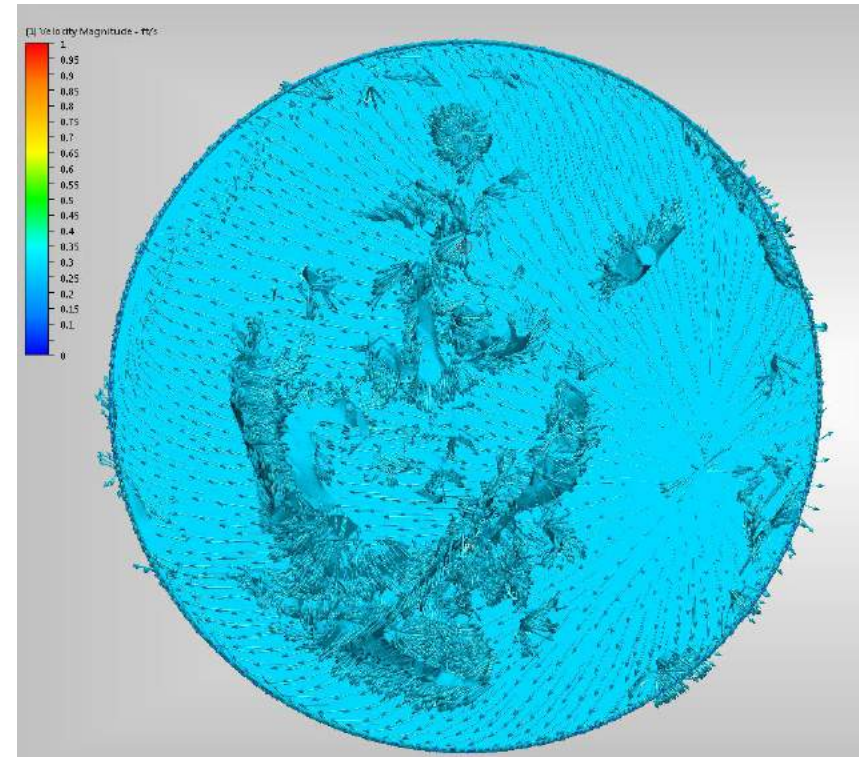
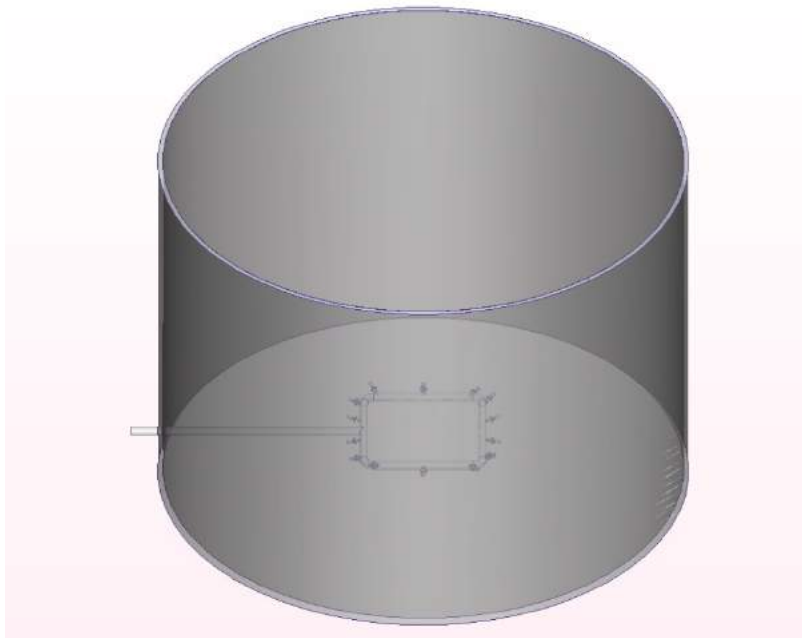
Electricity bill cost calculator. Electricity usage consumption calculator.

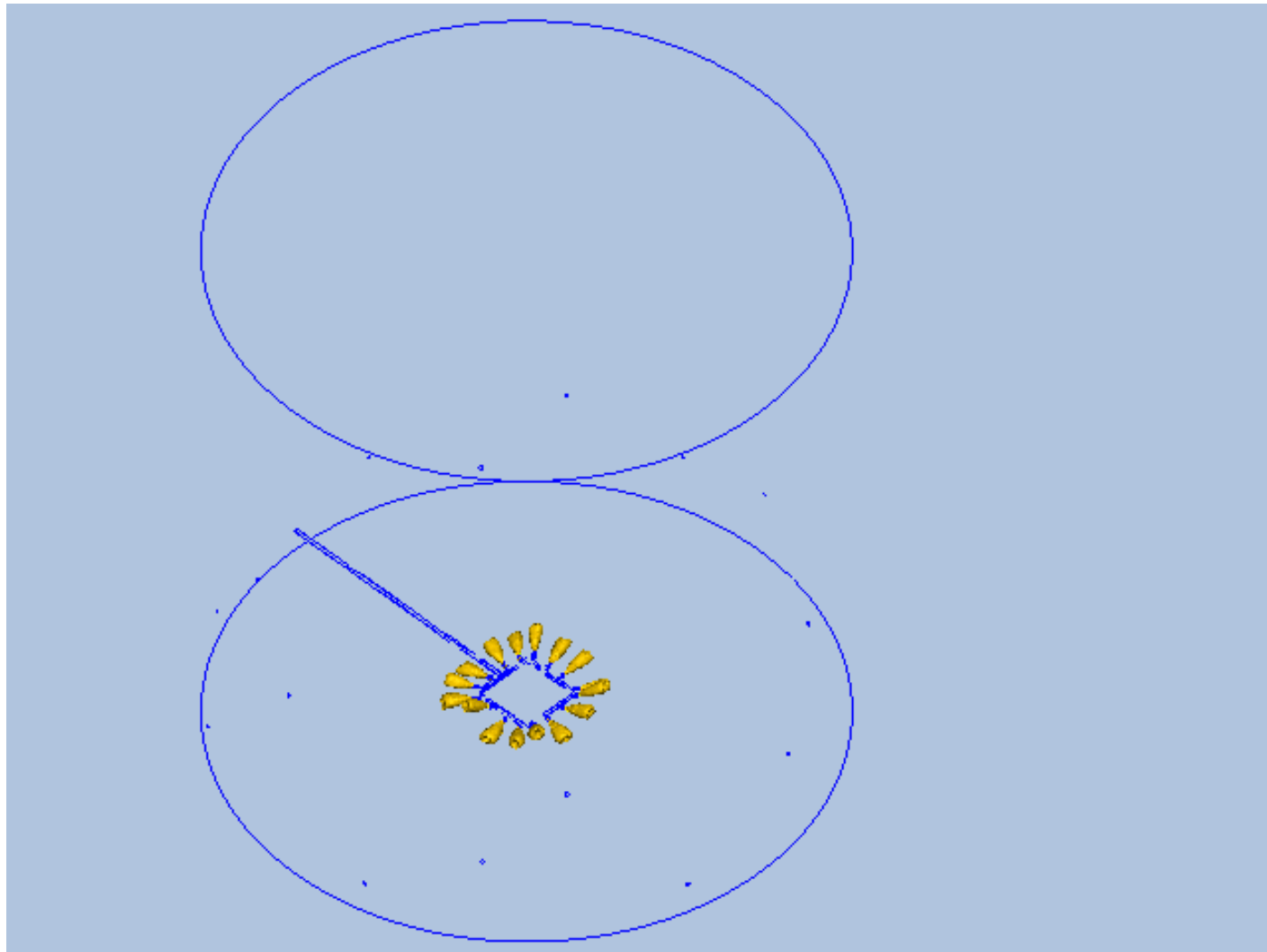
Select country:	United States	▼
Typical appliance:	-- select --	▼
Power consumption:	6.41	kilowatts (kW) ▼
Hours of use per day:	24	h/day
1 kilowatt-hour (kWh) cost:	12	cent ▼
Calculate Reset		
Electricity cost per day:	\$18.4608	
Electricity cost per month:	\$561.901	
Electricity cost per year:	\$6742.81	

TLA Yearly Savings = \$8,941.29

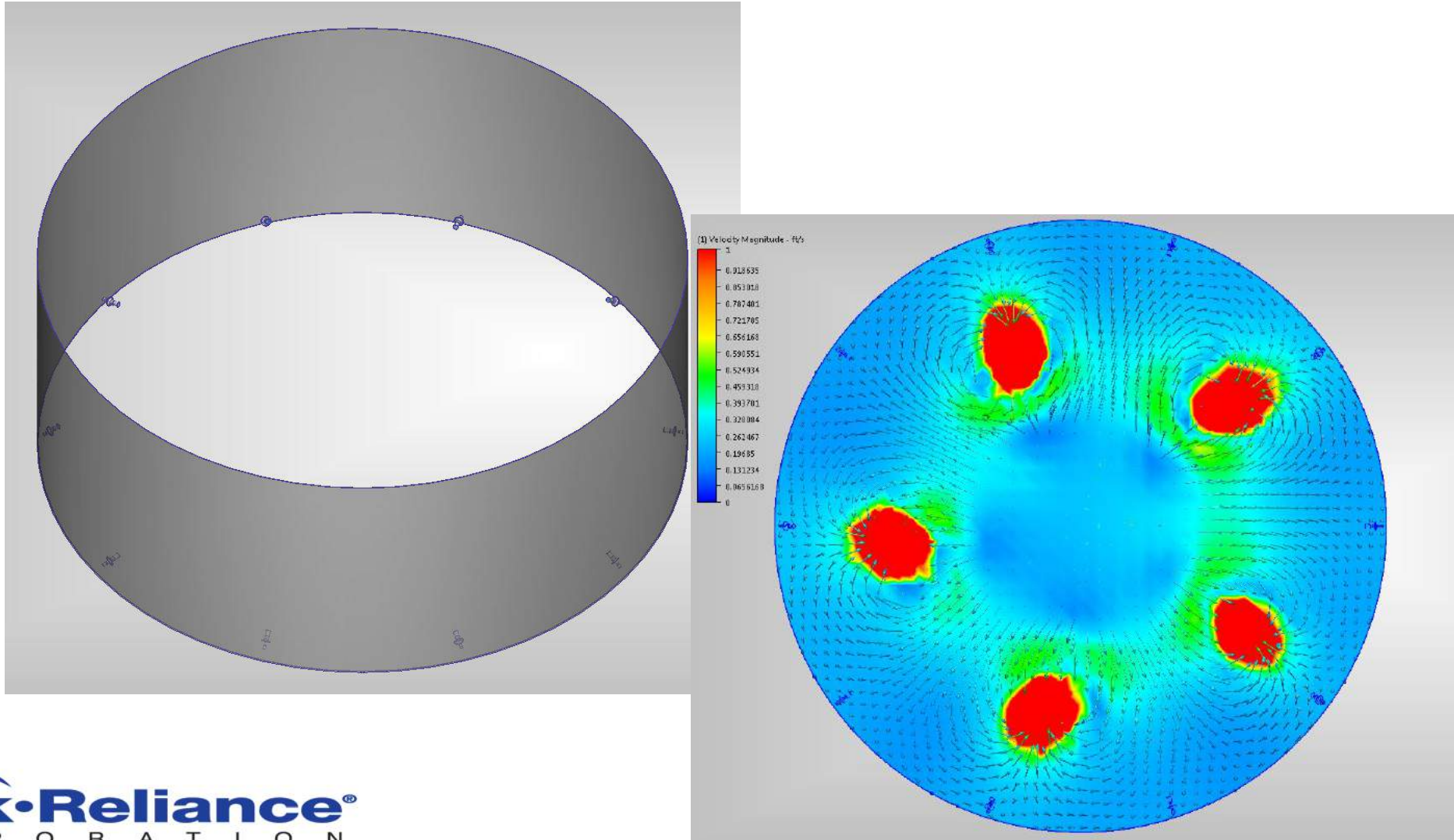
CFD Simulation

- We will model the customer's tank design and simulate directional flow based on customer specs. Jacoby-Tarbox® is the ONLY one able to model your application!



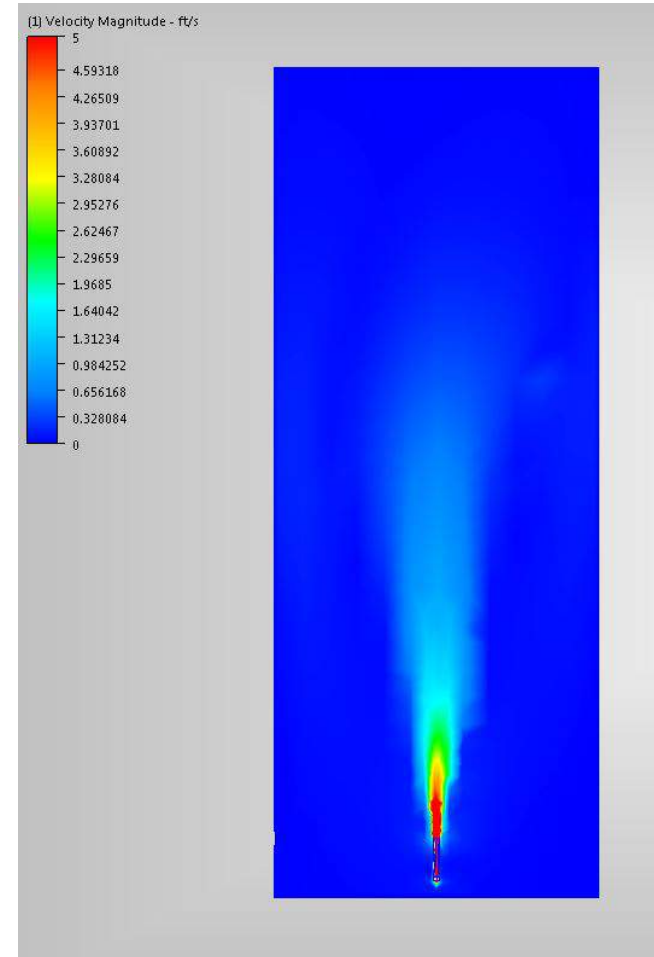
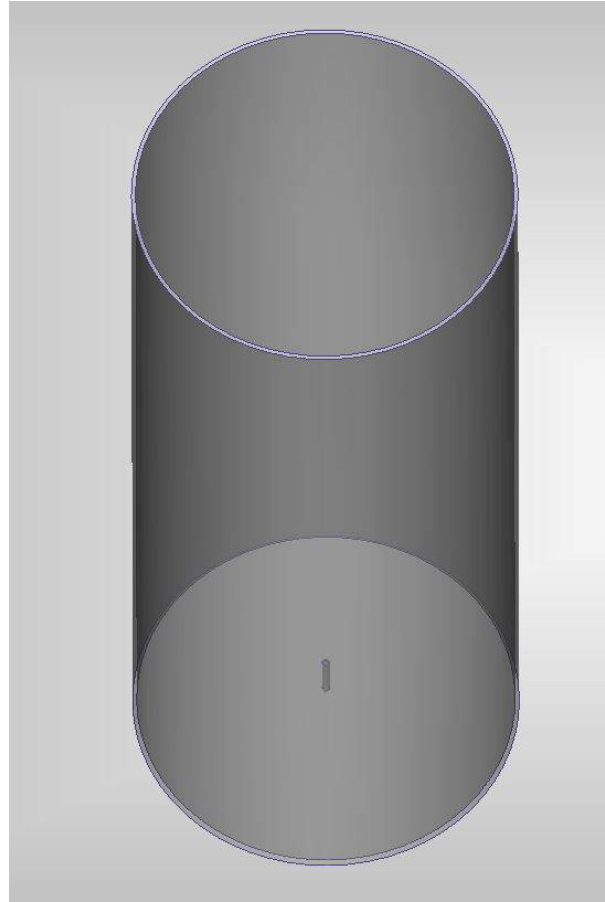


CFD Simulation Cont.



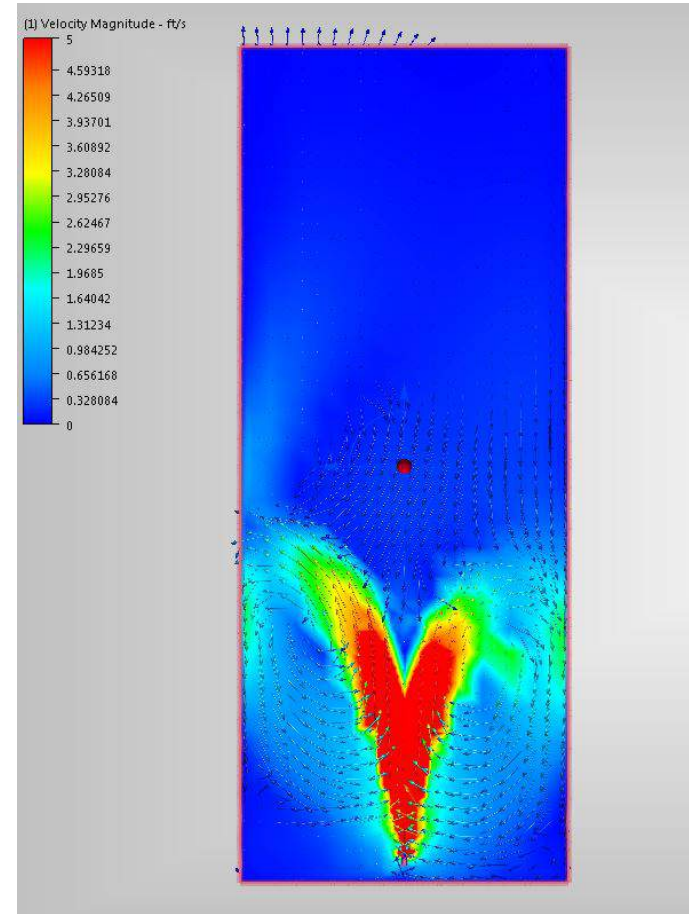
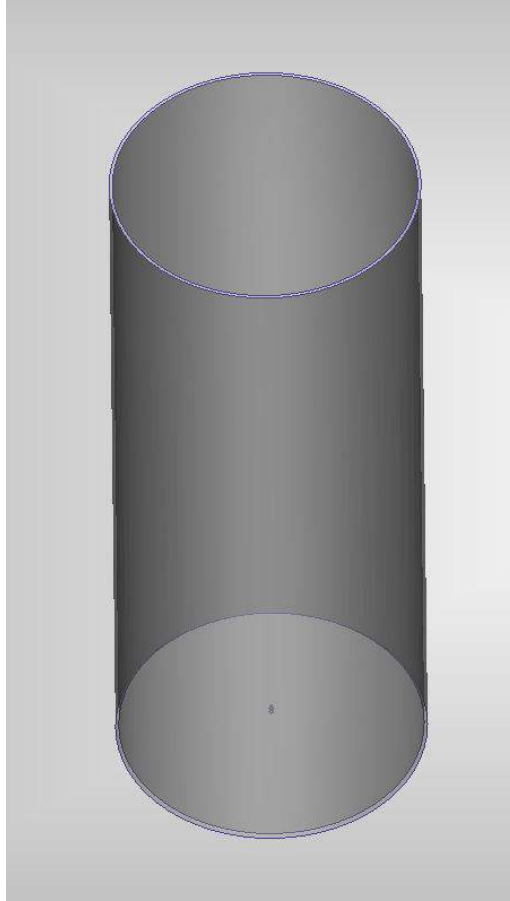
Misconceptions

- A pipe attached to a pump will be sufficient enough to mix

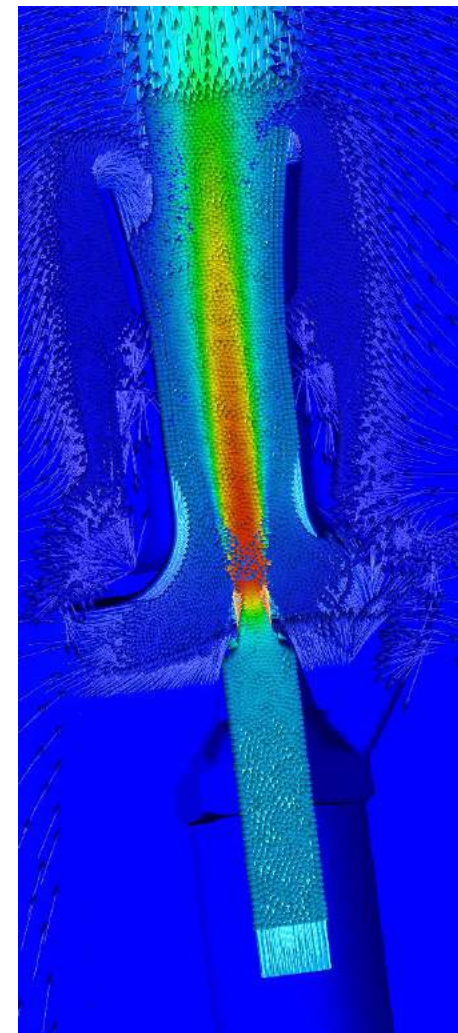
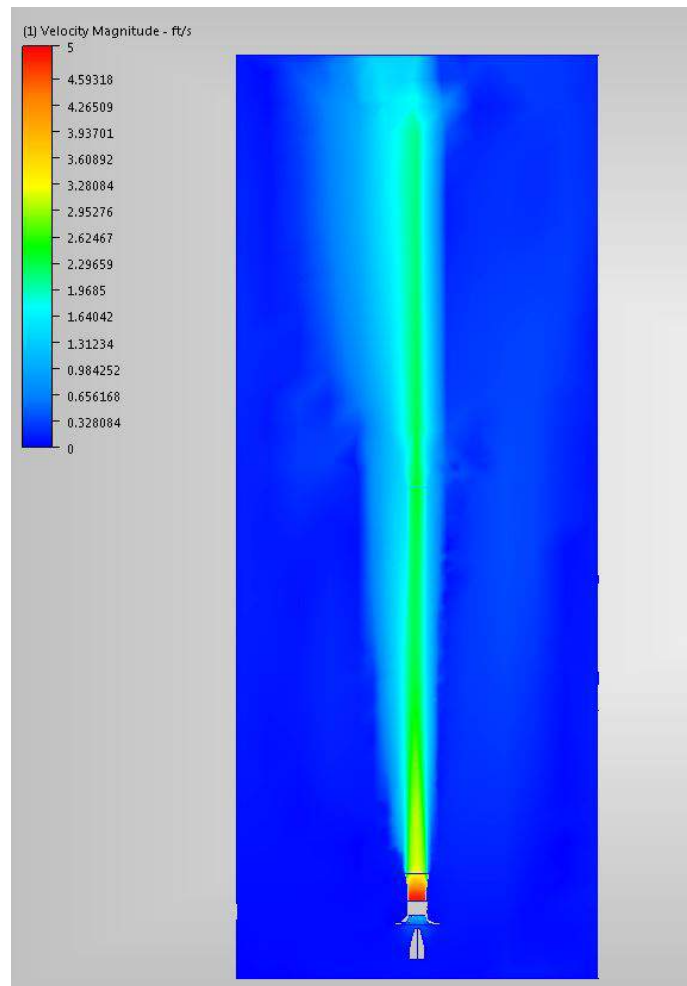
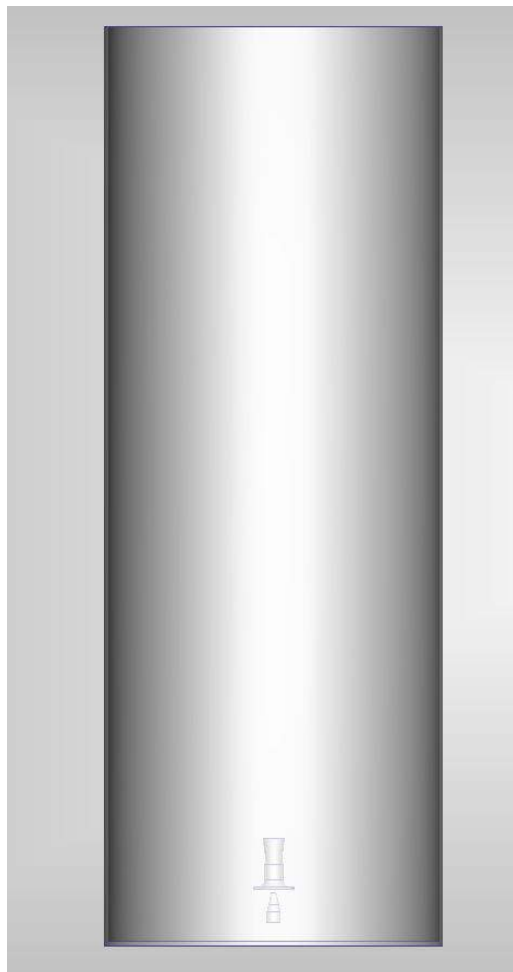


Misconceptions

- A nozzle attached to a pump will be sufficient enough to mix

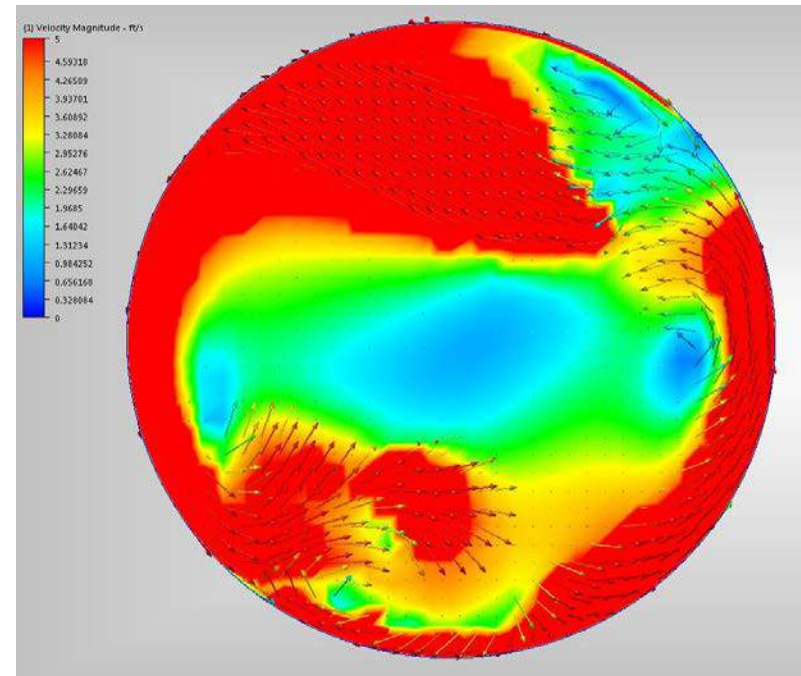
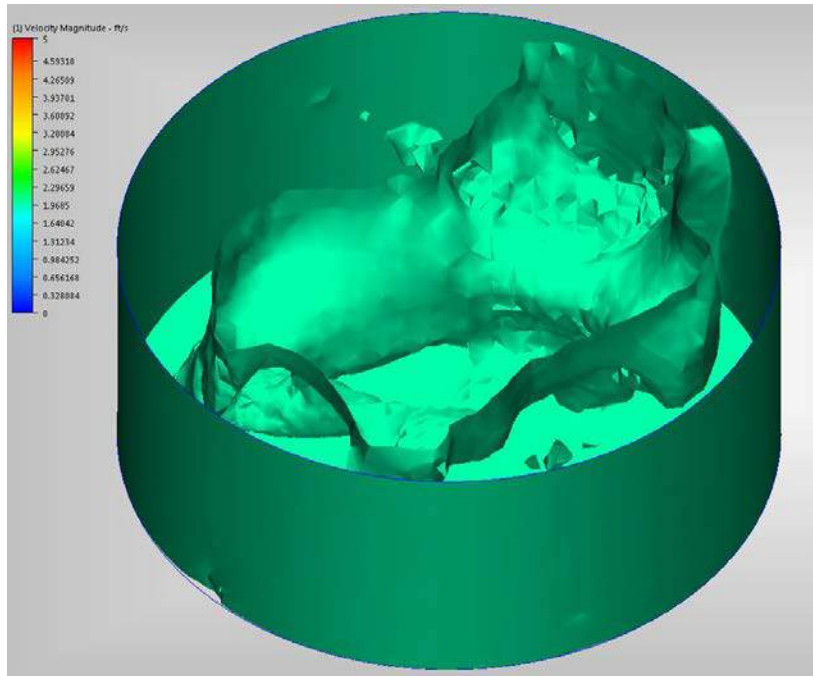


Efficiency Starts from the Design

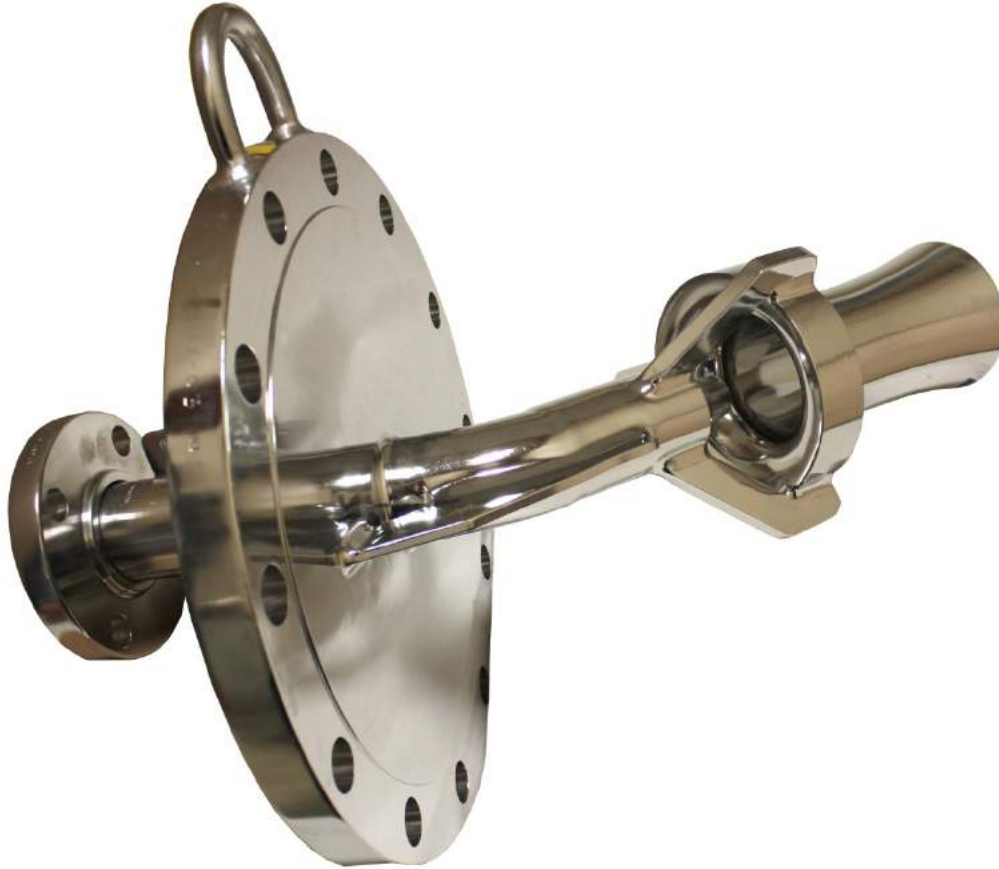


Success Stories

- Refinery in Louisiana: 8" TLAs for mixing / heating diesel fuel
 - Knocked out competition because of CFD



Success Stories

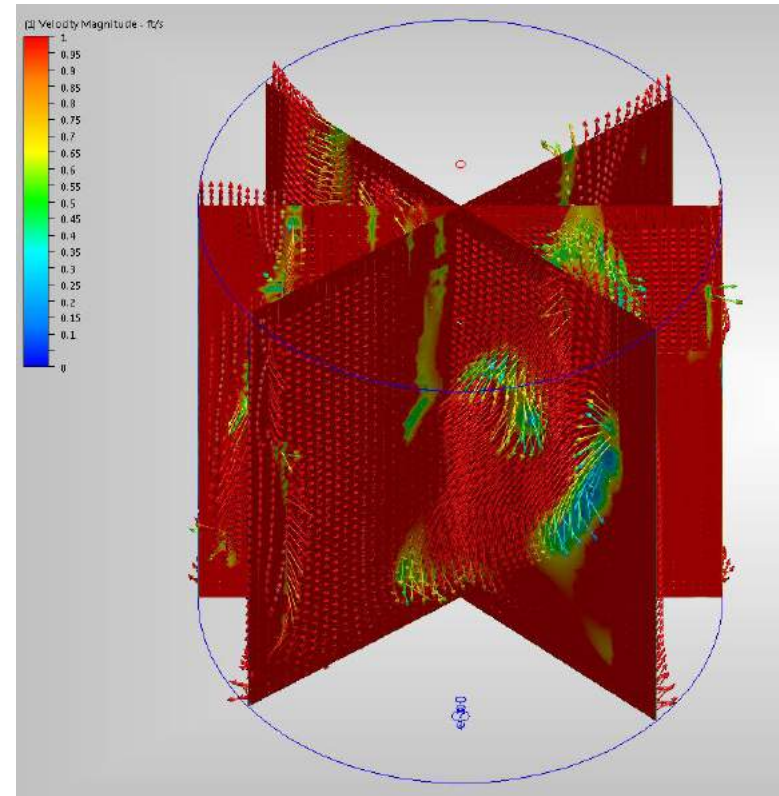


- Munitions plant
Blending acetic acid, water, and explosives particulates
 - Electropolished at 15 Ra
 - Design and weld specific to BAE's application

Success Stories



- Car manufacturer:
Neutralization Tanks

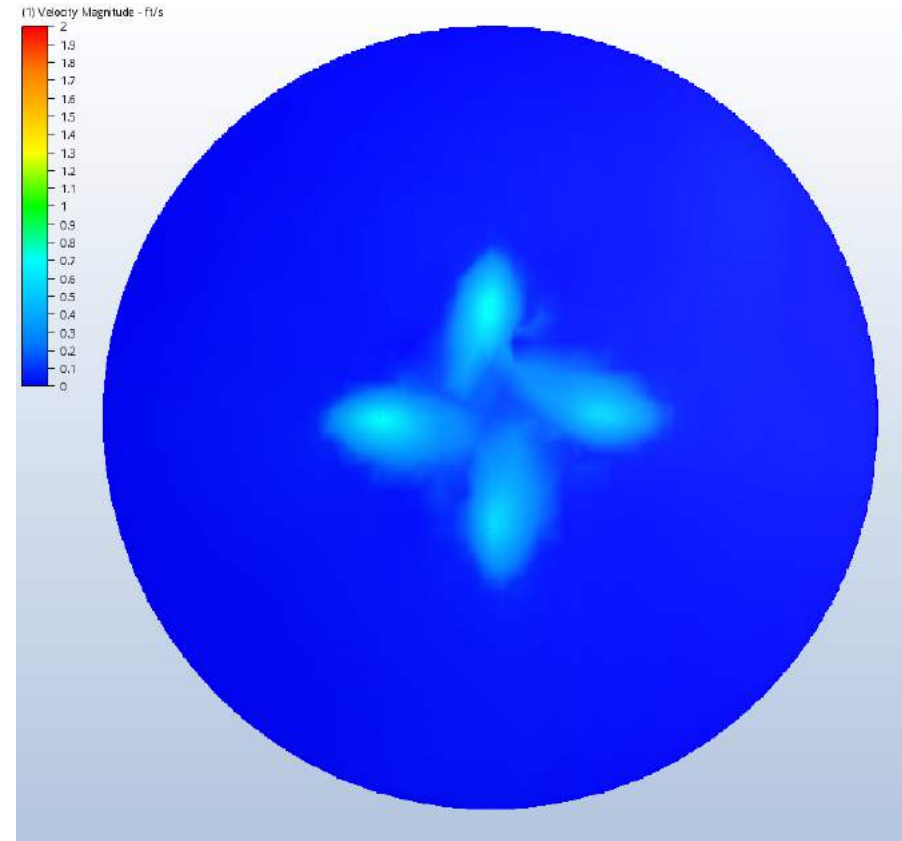
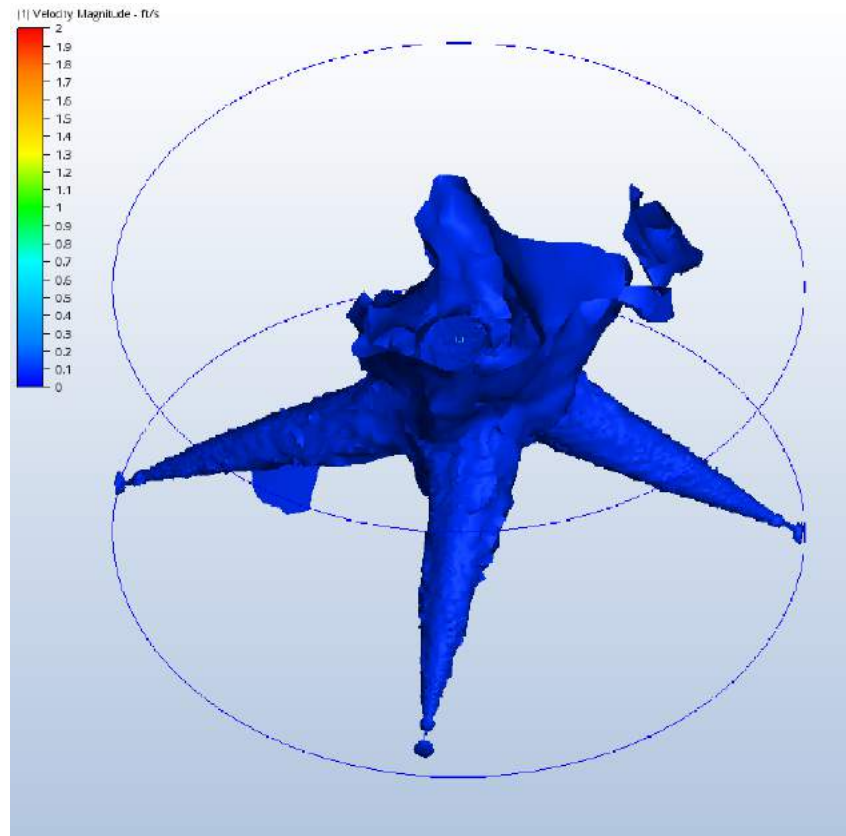


Success Stories

- Refinery: Test tank (asphalt) that converted nozzles into TLAs
- Will replace all existing nozzles in 30 tanks to TLAs
- CFD played a key role

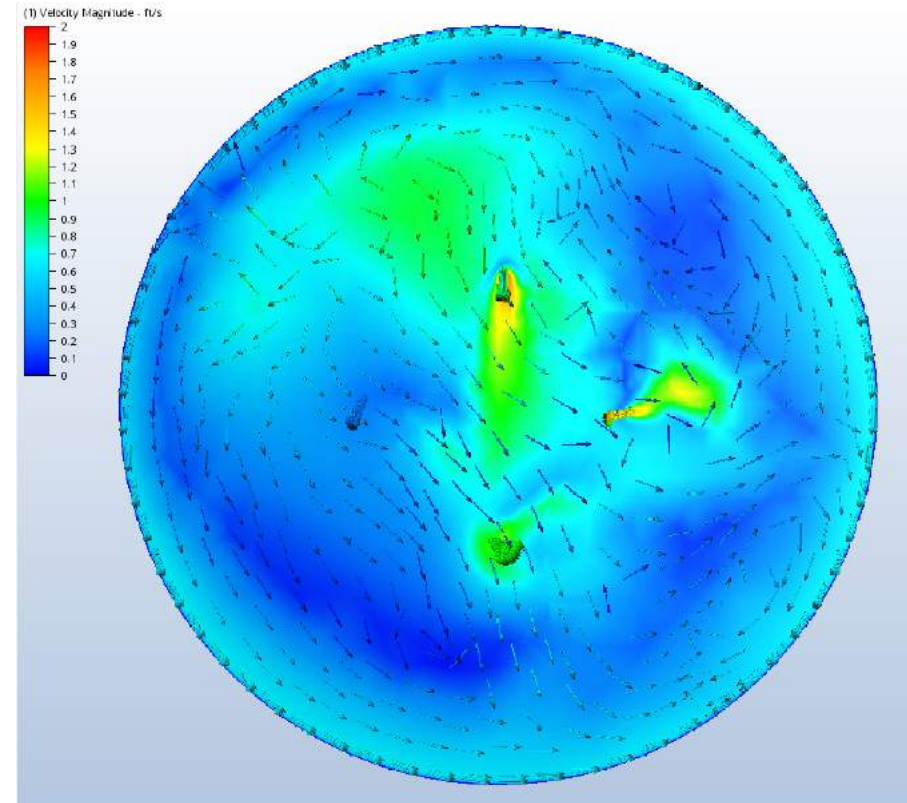
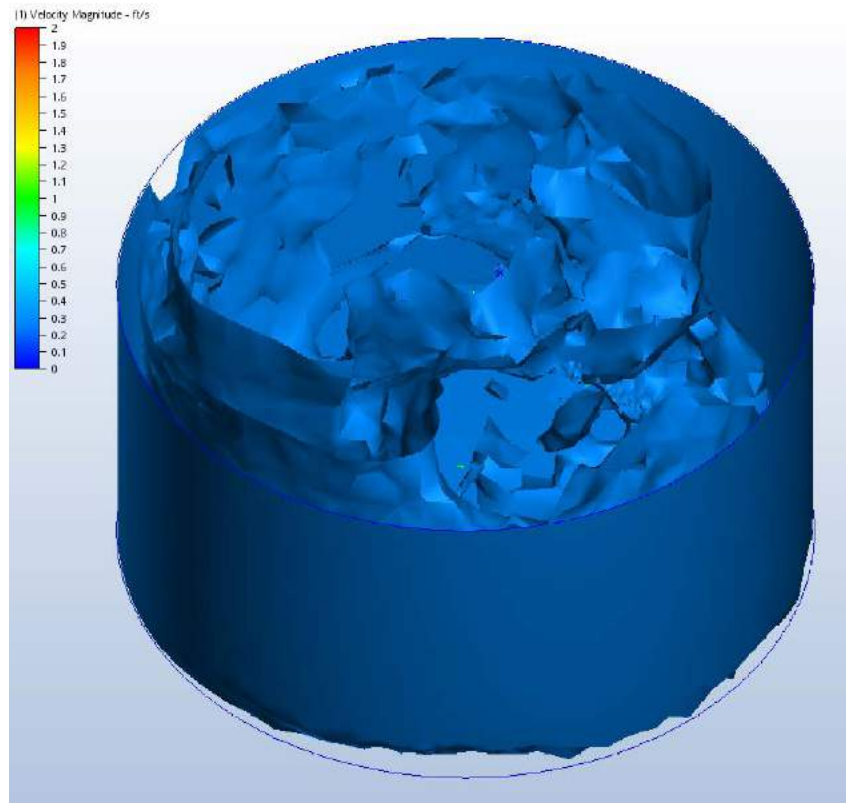
CFD Results for Refinery

1-1/2" Nozzles: Max Blend



CFD Results for Refinery

1-1/2" TLAs: Max Blend



Success Stories



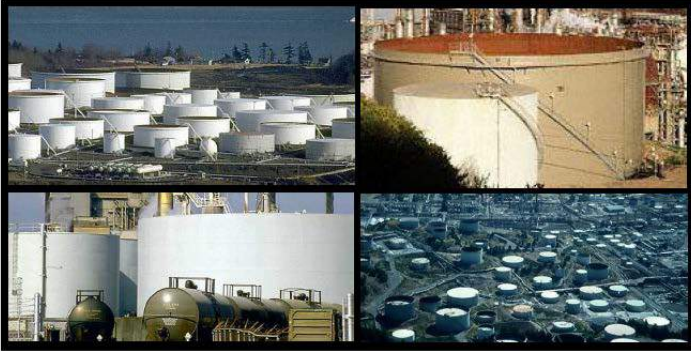
- Ethanol plant
- Heating corn slurry using biomass mixers

Tools Available for Eductors

Eductor Literature

Section: E100
Bulletin: E100.00
Date: 7/2015
Supersedes E100.00 (00)

Jacoby-Tarbox® Eductors™ for Non-Powered Mixing Applications



Proven Results



CFD
VERIFIED

by
AccuBlend CFD
A Jacoby-Tarbox® Program™

JACOBY-TARBOX®
A PRODUCT OF CLARK-RELIANCE

AccuBlend CFD

A Jacoby-Tarbox® Program™

Eductors require no power, which means no moving parts. The design of the eductor creates pressure differential allowing fluid to flow naturally within the device - creating suction, mixing, and pushing the liquid throughout the tank.

Jacoby-Tarbox® TLAs™ & Jacoby-Tarbox® In-line Eductors™ are designed and built to provide optimum performance.

Proven Results

“Without the AccuBlend CFD (Computation Fluid Dynamics) information to review, we would not have considered eductors for this project.”

Note – mechanical mixers were used previously

Senior Project Specialist
for an International Car Manufacturer

We can prove it !

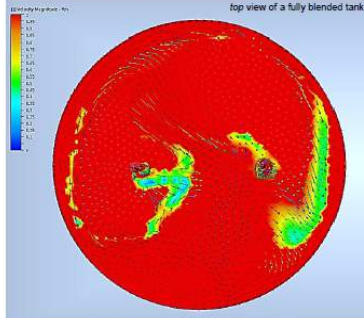
Jacoby-Tarbox® is the only Eductor manufacturer that can design your mixing solutions based on actual computational data.

Send us your specifications:

1. Goal of Mixing:
blend, suspend solids, stratified layers, heating
2. Tank or Reservoir dimensions
3. Fluid properties
4. Turnover time

We will send you the proof !





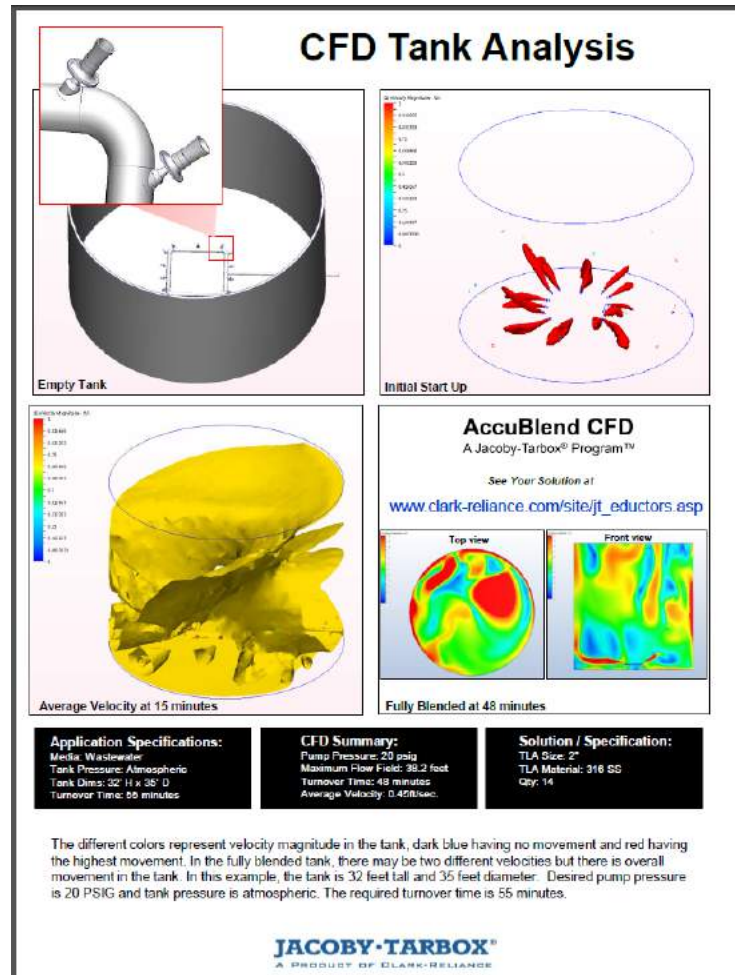
top view of a fully blended tank
Actual screen-shot of AccuBlend CFD

Our engineers will simulate your mixing application in our **AccuBlend CFD** (Computational Fluid Dynamics) program and show you the stages of mixing, including flow and directional velocities, until fully blended.

We can provide the number of TLAs required for your mixing needs and visually show; velocity profiles, velocity of the fluid in the tank, and a digital video snapshot of your tank being mixed over time.

JACOBY-TARBOX®
A PRODUCT OF CLARK-RELIANCE

Eductor Literature Cont:



Jacoby-Tarbox® In-Line Eductors™

In-line Eductors are the *Next Generation* of jet pumps, ejectors, and venturi pumps, providing in-line mixing, pumping, or heating in various process lines. Eductors decrease costs as there are no moving parts and require no direct power.



Jacoby-Tarbox®

offers a wide variety of materials depending on your specific application:

- Carbon Steel
- 316 Stainless Steel
- Bronze
- PVC / CPVC
- PVDF
- Monel®
- Alloy 20
- Hastelloy® C
- Duplex
- Stellite®

... a greener, safer solution

CFD Validated Design, Full ASME Rating

- CFD used to maximize efficiency and performance
- Smooth specified finish for optimum flow paths
- Mixing tube section designed to withstand pipe stress
- Wrench flats to prevent damage during installation

Superior by Every Measure

- Backed by superior application engineering services
- Supplied to meet your delivery schedules
- Designed and built in the USA

To obtain your AccuBlend CFD tank analysis, eductor inquiries, application questions or quotes, please contact us at: eductors@clark-reliance.com or call at 440-572-1500.

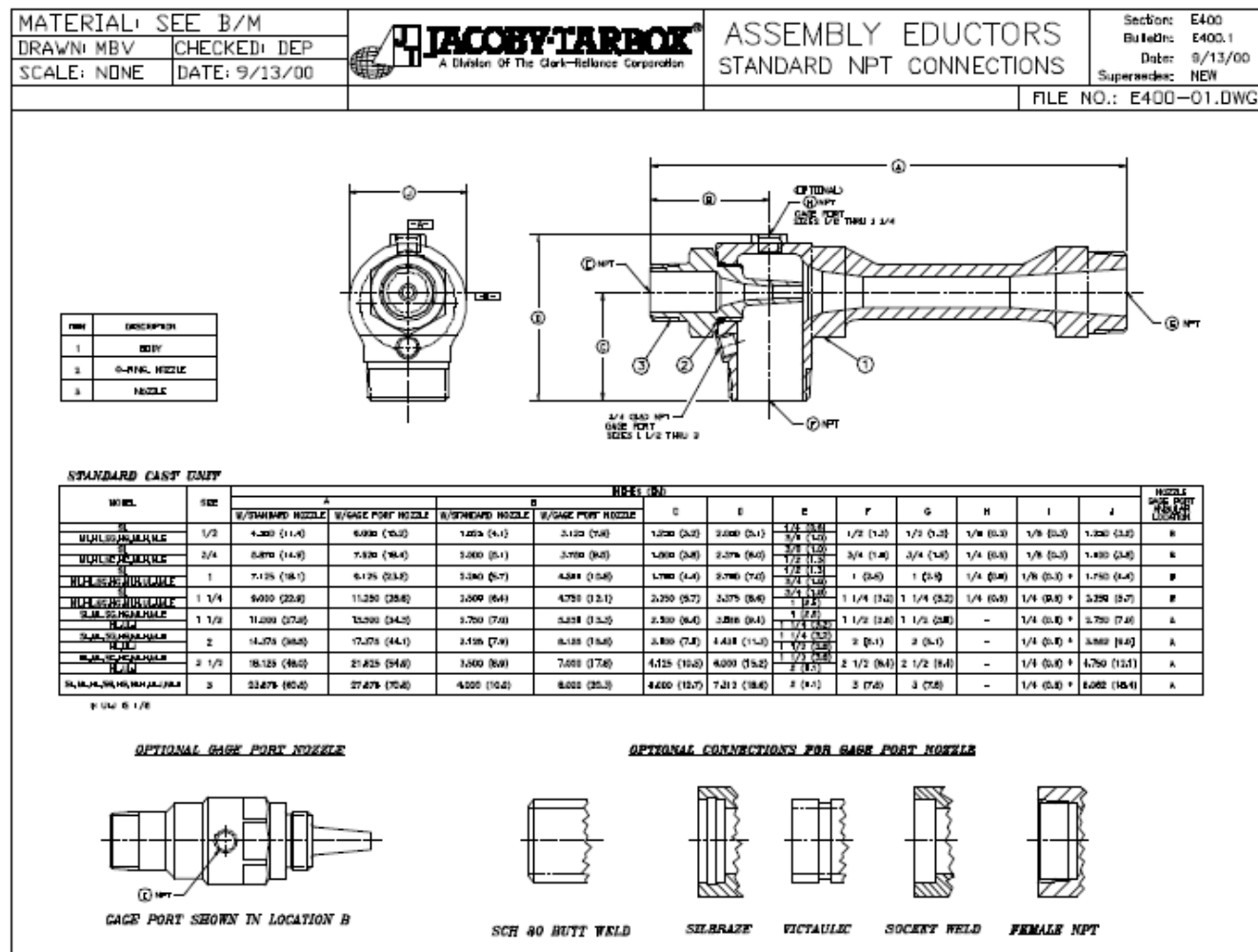
Please visit www.clark-reliance.com for more information on Jacoby-Tarbox Products including Eductors, Sight Flow Indicators, Sight Windows and Illumination options.

Immediate availability in online store at www.clark-reliance.com/parts

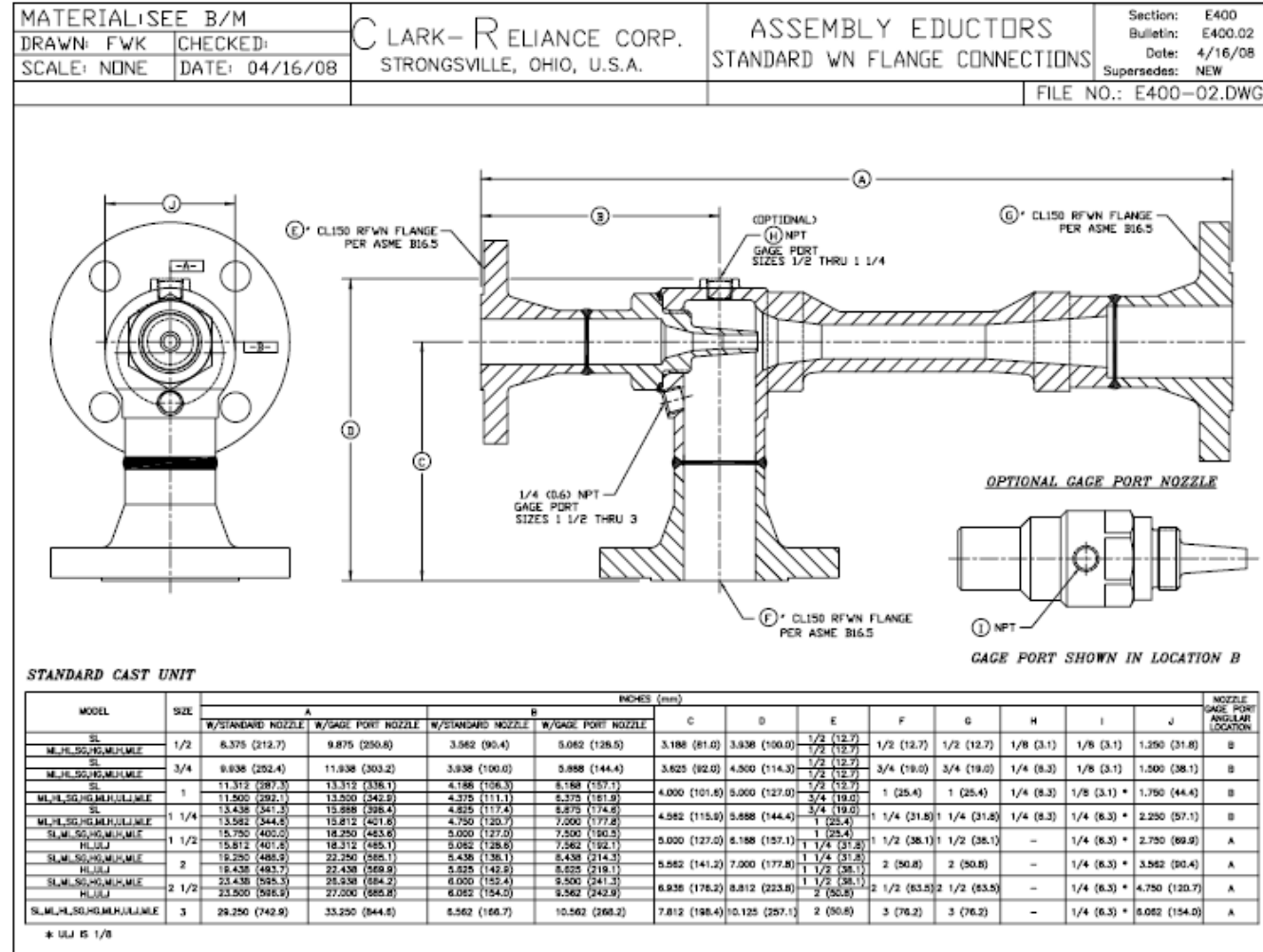
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+440-572-1500 (phone) +440-238-8828 (fax) sales@clark-reliance.com

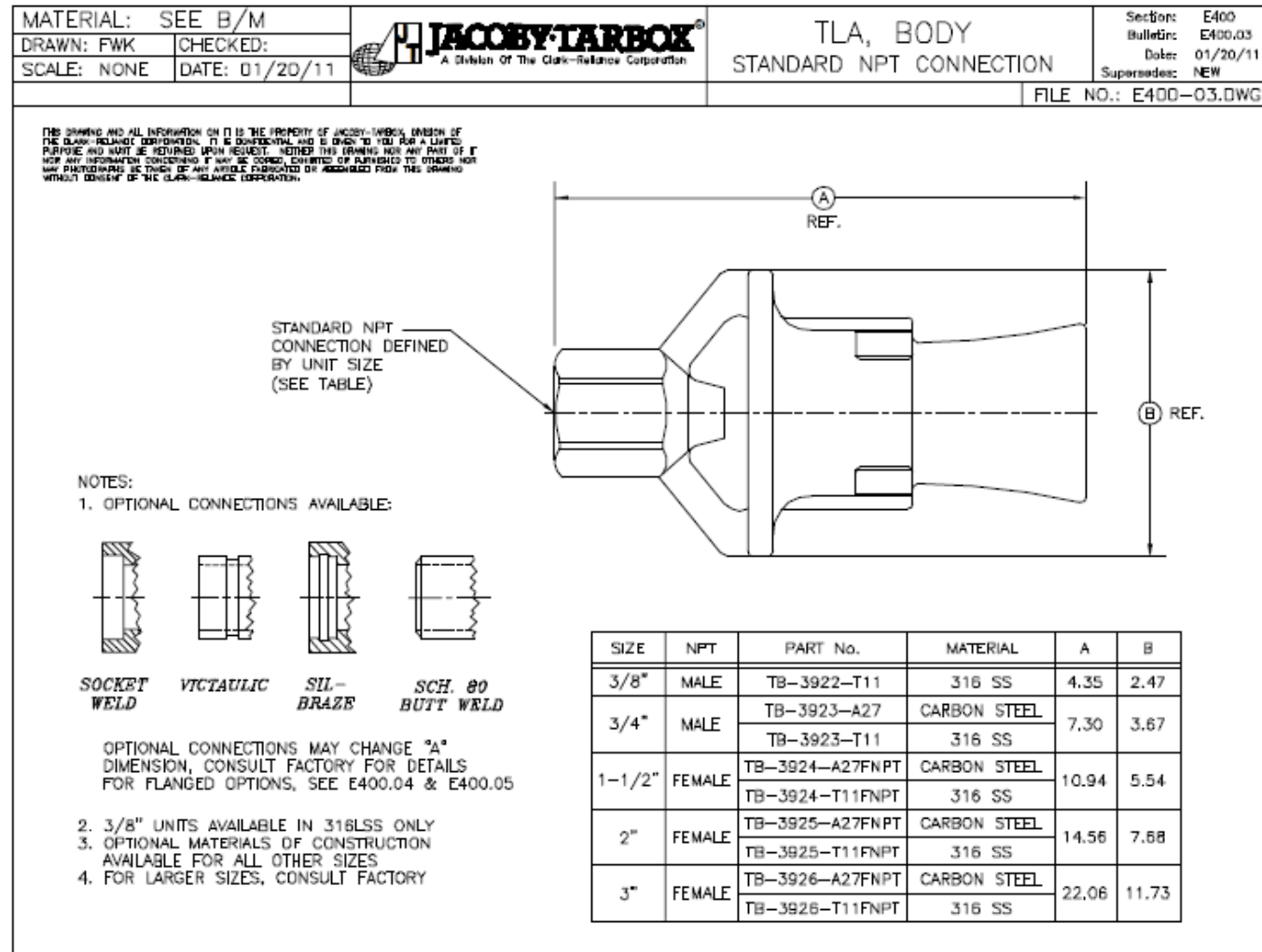
Eductor Drawings



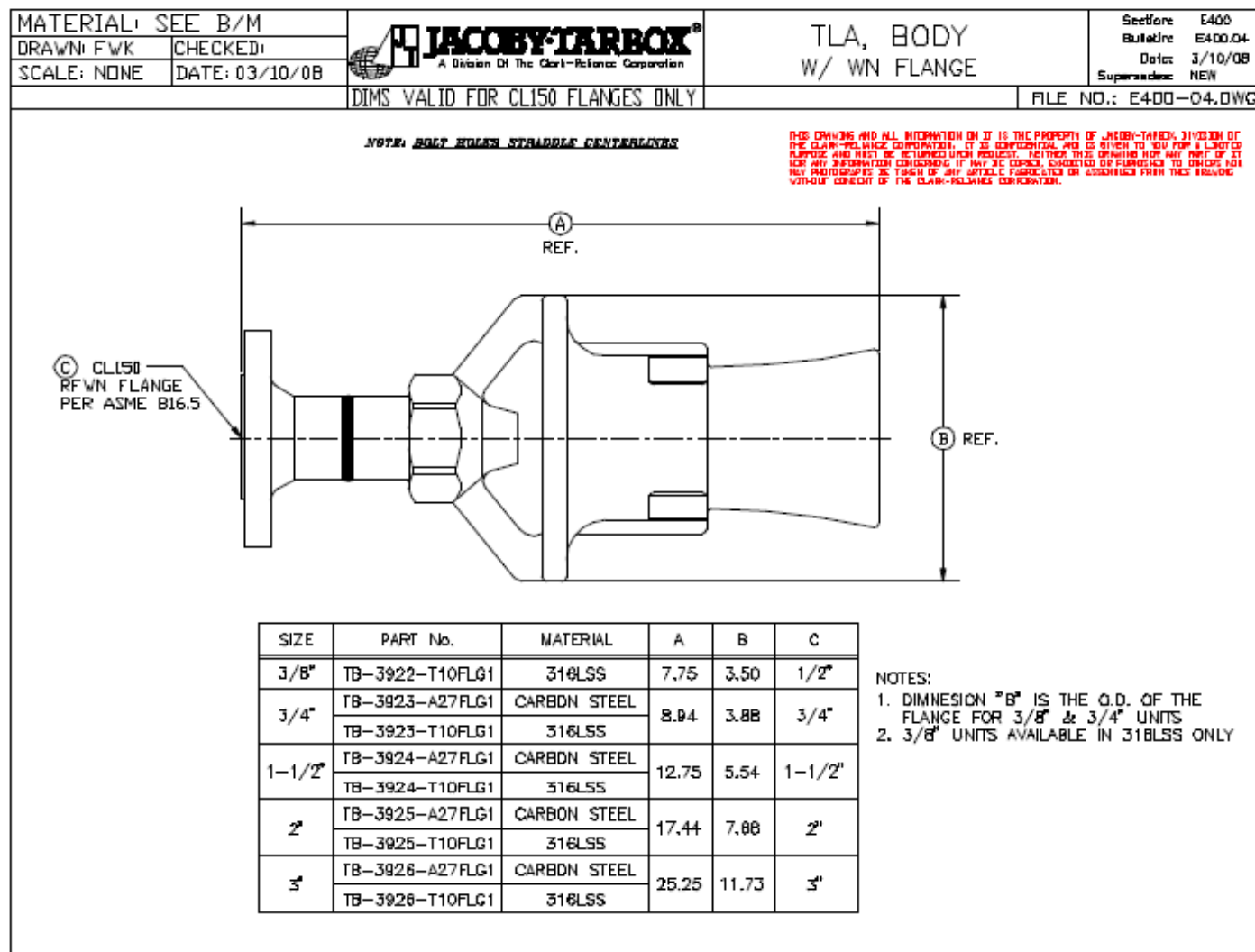
Eductor Drawings



Eductor Drawings



Eductor Drawings



Eductor Sizing Sheets

JACOBY-TARBOX® In-Line Eductor Application Sizing
A PRODUCT OF CLARK-RELIANCE
16633 Foltz Parkway • Strongsville, OH 44149
www.clark-reliance.com • +1 440-672-1500 • +1 440-238-8828 Fax

Section:	E300
Bulletin:	E300.1
Date:	01/13/12
Supersedes:	07/31/09

Date: _____ Quotation: _____

Company: _____

Attention: _____ From: Clarence Dela Vega Model: _____

Phone: _____ Phone: 440-846-7653 Size: _____

E-mail: _____ E-mail: cdelavega@clark-reliance.com Mat'l: _____

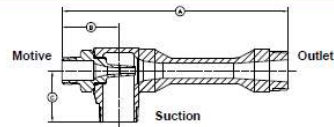
Reference: _____ Part No: _____

Item:	Tag No:	Price:	Del'y:	wks
Motive Conditions:				
Units:	Connection	Size:	Type:	
Media:	Customer Supplied Information:		Quoted Unit Performance:	
Pressure: (all)				
Flow: (all)				
Temperature: (h)				
Sp.Gr. / Density:				
Other:				
Suction Conditions:				
Units:	Connection	Size:	Type:	
Media:	Customer Supplied Information:		Quoted Unit Performance:	
Pressure: (all)				
Flow: (all)				
Temperature: (h)				
Sp.Gr. / Density:				
Other:				
Outlet Conditions:				
Units:	Connection	Size:	Type:	
Pressure: (all)	Customer Supplied Information:		Quoted Unit Performance:	
Temperature: (h)				
Other:				

Key: pl=pumping liquids pg=pumping gases h=heating ps=pumping slurries p=pneumatic transport

Application Notes:
1) *Delivery is ex-works (international) or FCA (domestic) once the purchase order is accepted.
2)
3)

Dimensions	
A	
B	
C	



JACOBY-TARBOX® TLA Eductor Application Sizing
A PRODUCT OF CLARK-RELIANCE
16633 Foltz Parkway • Strongsville, OH 44149
www.clark-reliance.com • +1 440-672-1500 • +1 440-238-8828 Fax

Section:	E300
Bulletin:	E300.2
Date:	12/19/13
Supersedes:	01/13/12

Date: _____ Quotation: _____

Company: _____

Attention: _____ From: Clarence Dela Vega Model: TLA

Phone: _____ Eductor Sales Specialist Size: 10"

E-mail: _____ Phone: 440-846-7653 Mat'l: Rubber Lined

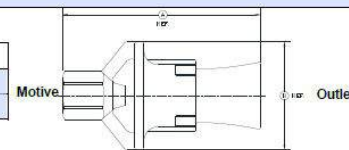
Reference: _____ E-mail: cdelavega@clark-reliance.com Part No: _____

Item:	Tag No:	Price:	Del'y:	wks
Motive Conditions:				
Units:	Connection	Size:	Type:	
Media:	Customer Supplied Information:		Quoted Unit Performance:	
Pressure: (all)				
Flow: (all)				
Temperature: (h)				
Sp.Gr. / Density:				
Other:				
Tank Conditions:				
Units:	Customer Supplied Information:		Quoted Unit Performance:	
Media:				
Pressure: (all)				
Total Flow: (L)				
Turnover Time:				
Flow Field:				
Temperature:				
Tank Volume:				
Tank Dim's:	Ht:	Dia:	Length:	Ht: Dia: Length:
Sp.Gr. / Density:				
Particle Size:				
Other:				

Please visit www.clark-reliance.com/parts for same day delivery if ordered before 2:00 PM

Application Notes:
1) *http://www.clark-reliance.com/terms
2)
3)

Dimensions	
A	
B	



CFD Analysis Available!

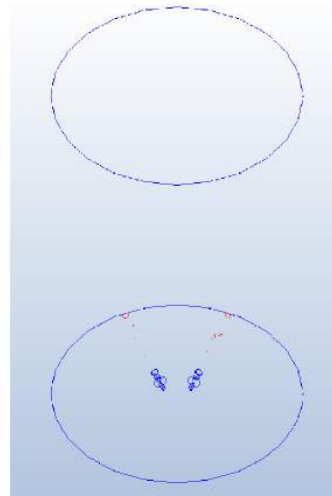


CFD Analysis

Attention: Dan Scott
Customer: WesTech Engineering

JACOBY·TARBOX®
A PRODUCT OF CLARK-RELIANCE

CFD Analysis (Computational Fluid Dynamics)



CFD Number: E999-2507

Application Specs:

Media: waste water
Pressure: NA
Tank Dims: Ht = 46 ft, Dia = 12 ft
Turnover Time: 20-30 minutes

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Prepared by: Clarence Dela Vega
E-mail: cdelavega@clark-reliance.com
Phone: 440-846-7653

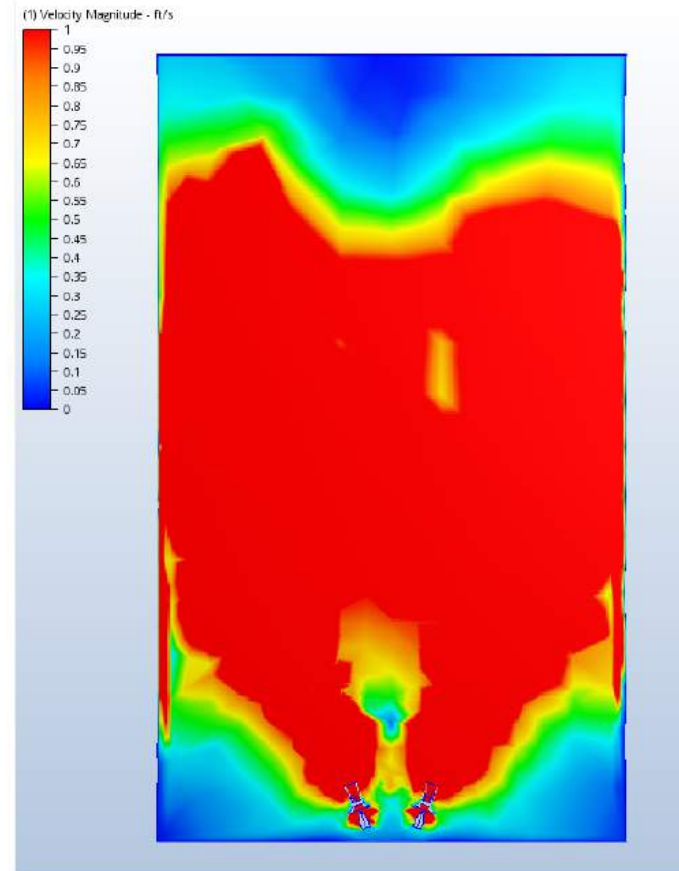
9/12/2017

1

Attention: Dan Scott
Customer: WesTech Engineering

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Velocity Vector: Full Blend Side View (17 minutes)



9/12/2017

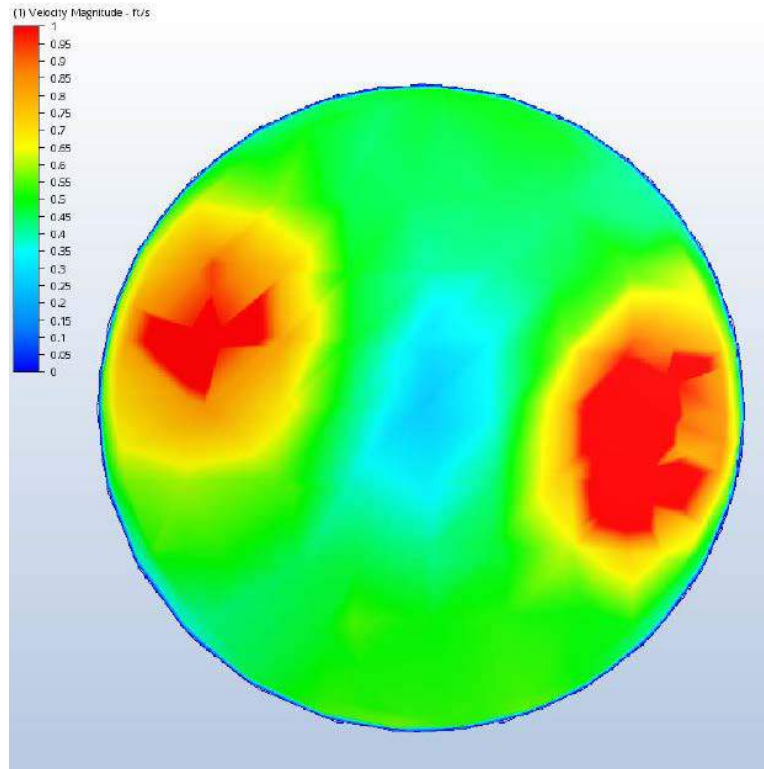
8

CFD Analysis

Attention: Dan Scott
Customer: WesTech Engineering

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Velocity Vector: Full Blend Top View (17 minutes)



9/12/2017

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Attention: Dan Scott
Customer: WesTech Engineering

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Initial Application Specs:

Media: waste water
Pressure: 20-30 PSIG
Tank Dims: Ht = 46 ft, Dia = 12 ft
Turnover Time: 20-30 minutes

CFD Summary:

- Media: waste water
- Pump Pressure: 40 PSIG differential
- Maximum Flow Field: 73 feet
- Turnover Time: 17 minutes each turnover
- Average Velocity: 0.35 feet / second

Spec Summary:

- TLA Size: 3"
- TLA Material: CPVC
- Qty: 2 units per tank

Confirmed by:

Clarence Dela Vega – Product Engineer

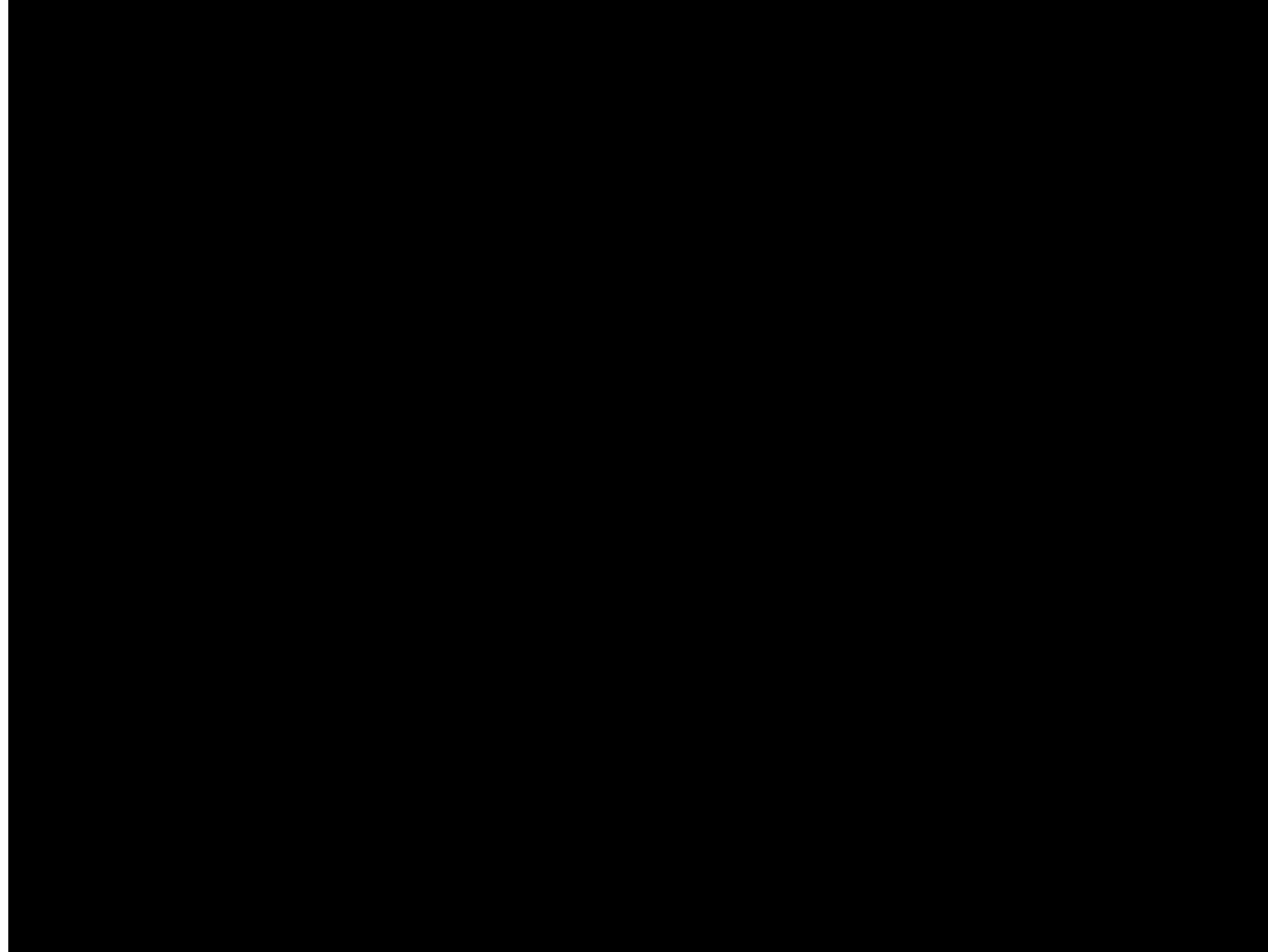
9/12/2017

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Exotics and Fabricated Eductors



CFD Educator Video



Additional Information

Factory Contact:

Clarence Dela Vega:

cdelavega@clark-reliance.com

Phone: 440/846-7653 / Fax: 440/238-8828

Address:

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16633 Foltz Parkway

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Questions?



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