



Energy Specialties International

Leaders in Produced Water & Wastewater Technology



www.energyspecialties.com



Energy Specialties International

Energy Specialties International (ESI) is a Texas Corporation engaged in the sale, engineering, design, manufacturing, installation and technical servicing of Produced Water & Wastewater Treatment equipment. ESI has spent years improving traditional equipment such as our Skim Pile disposal caisson, Quadair induced gas flotation unit (IGF) and corrugated plate interceptors (CPI) while continuing to develop new products such as the patented Spiral Ramp LQ-R Hydrocyclones & Vertifloat Compact Flotation Unit (CFU).

ESI offers complete and tested water treatment packages which combine all phases of Produced Water & Wastewater Treatment on one skid. Because our packages often include piping, instrumentation and electrical, the customer has few tie-in connections.

ESI guarantees all equipment and system packages' performance. So when you need a Produced Water Conditioning System, Wastewater Treatment equipment or have a difficult separation problem, turn to the experts...**ESI**.

API-421

A 3-phase separator for large particles (150xm) designed to provide constant flow for downstream equipment.



FLOTATION PILE

A patented Sump Caisson utilizing Baffles, Oil Risers and Flotation offering the best separation technologies in one offshore caisson.



SPIRAL RAMP LQ-R HYDROCYCLONES

Improves efficiency by providing a long entry conduit, wrapping it around the hydrocyclone, so the feed enters via a spiral ramped path.



SKIM PILE

An internally plated vertical sump caisson designed to remove free oil (>50 m) from Open and Closed Drains.



CORRUGATED PLATE INTERCEPTOR (CPI)

45° Down-flow Parallel Plate Separator designed and sized to remove oil and sand from wastewater.



DISPOSAL PILE

An un-plated vertical sump caisson designed to dispose of Produced Water and contain upstream equipment upsets.



QUADAIR FLOTATION UNIT

A four-cell flotation system designed to float out emulsified oils and suspend solids by inducing gas bubbles.



OIL REMOVAL

ESI offers a full range of oil removal solutions for cleaner water and low maintenance costs.



VERTIFLOAT CFU

A single cell vertical compact flotation unit designed to purify produced water using two stages of oil droplet coalescence along with a single flotation compartment.



UPFLOW CPI

60° Up-flow Parallel Plate Separator designed and sized to remove and clean solids from wastewater.



Hydrocyclone

Improves efficiency by providing a long entry conduit, wrapping it around the hydrocyclone, so the feed enters via a spiral ramped path.



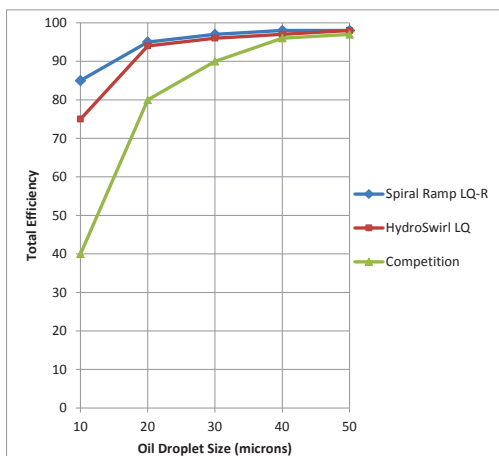
SPIRAL RAMP LQ-R

- Patent spiral ramp entry
- Geometry creates vortex to enhance gravity
- Oil droplets coalesce in central core (> 4-20 microns)
- Multi-million dollar R&D for best performance
- Insensitive to motion or surges
- No chemicals or power (if high enough pressure)
- Small oily reject stream (2% of inlet flow)
- No moving parts
- Compact design



From testing, it is obvious that a long entry path into the hydrocyclone liner improves efficiency. This is due to the decrease in turbulent shear as the droplets enter the hydrocyclone through a long conduit. Until now, there was no solution to the conflicting requirements of having a long entry conduit for each liner in a pressure vessel and keeping the vessel diameter to a minimum.

The Spiral Ramp LQ-R Hydrocyclone overcomes the conflicting requirements mentioned above by providing the long entry conduit, but wrapping it around the hydrocyclone so that the feed enters the hydrocyclone via a ramped spiral path. This makes for a much improved entry into the hydrocyclone. The feed stream of oily water spirals around the hydrocyclone before entering the feed chamber itself. This preshapes and starts the separation of the feed mixture, while at the same time, reduces the shear and effectively increases the residence time in the hydrocyclone liner.



Proven Results

Tests at a major University show that this new design can improve the efficiency of hydrocyclones by as much as 50%. The spiral ramp LQ-R Hydrocyclone design is presently patent pending.



API-421

The API-421 uses a variety of innovative technology (such as velocity-Head Diffusers, Reaction-Jets, Flight Rake System, Corrugated Plate Packs, Oil-Skimming Devices, etc.) to remove oil from wastewater onshore.



API-421 SKIMMER

The ESI API-421 Separator is a gravity-type oil-water separator designed for use in petroleum refineries. Design criteria is based on the American Petroleum Institute's (API) Publication 421, "Design and Operation of Oil-Water Separators." Our API-421 Separator includes Diffusers, Reaction-Jets, Sludge Hopper, Flight & Rake System, Corrugated Plate Packs, Oil-Skimming Devices, etc. These internals reduce flow turbulence, distribute the flow evenly, help coalesce and remove the oil.

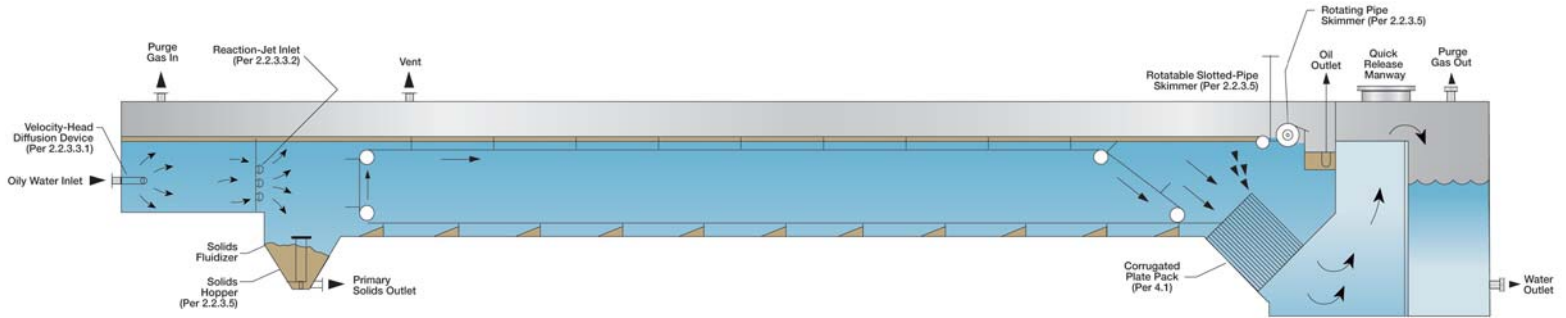
The following parameters are required for proper sizing and design:

Q_m = Design flow (maximum wastewater flow).

μ = Absolute/dynamic viscosity of the wastewater.

T = Lowest wastewater temperature.

S_o = Specific gravity of the oil-fraction.



Additional design constraints are as follows:

V_h = Horizontal Velocity should be $\leq 3\text{ft}/\text{minute}$ or $15x$ the oil globule rate of rise (V_t), whichever is smaller.

d = Separation Depth should be 3-8 feet.

Depth (separator) to width (separator) ratio should range from 0.3 to 0.5.

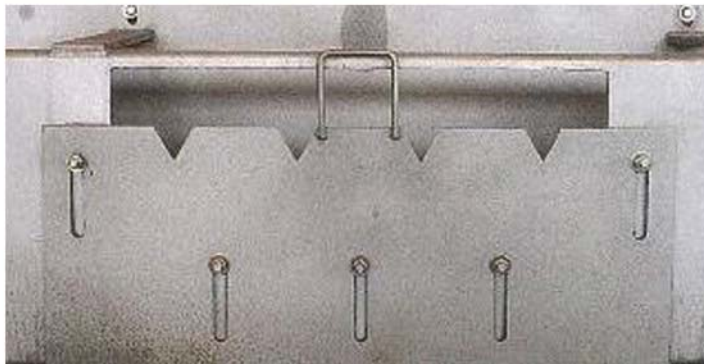
Separator width is usually 6-20 feet.

Two Channels are usually provided for servicing or cleaning one channel while the other is in service.

Length to width ratio (L/B) should be ≥ 5 .

API-421 Separator Package Includes:

- Engineered for Specific Application
- Inlet Distribution System
- Solids Collection and Removal
- Oil Collection and Removal
- Secondary Oil Removal with Optional Plate Pack



Downflow CPI

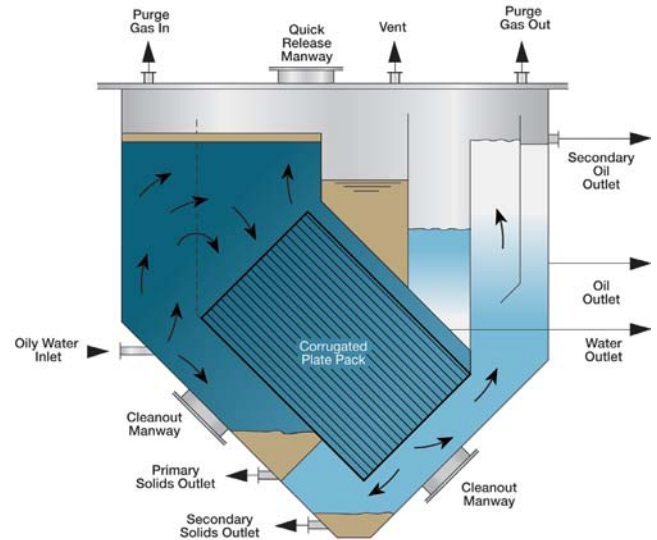
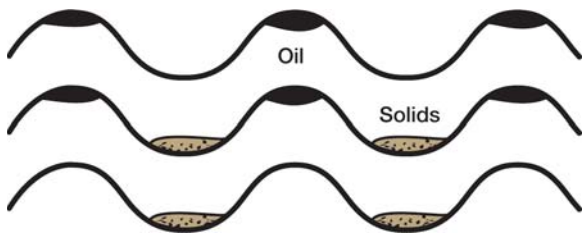
Our eco-friendly CPI recovers oil from water at the lowest cost while using minimal deck space and the least amount of energy.



ESI CORRUGATED PLATE INTERCEPTORS (CPI)

Design Principles

The ESI CPI is designed and engineered for oil recovery applications where energy usage and equipment costs are a determining factor. The CPI is a gravity separator where efficiency is determined by the rising velocity of the smallest particles that will be intercepted, usually greater than 50 microns. The plate pack is made of many closely spaced corrugated plates. Using Stoke's Law, the rate of rise of the oil can be calculated. The greatest advantage of the ESI CPI is that the rising distance is usually less than one inch. This allows the oil droplets to rise and coalesce to larger droplets or for sand to fall out of the flowing stream.



1. No Power Requirement
2. No Moving Parts
3. Compact Design/Minimum Footprint Required
4. Low Initial Cost

5. Low Operating Cost
6. Low Maintenance Cost
7. Droplet > 50 Micron
8. Plates @ 45° (Downflow)

9. Plates @ 60° (Upflow)
10. Plate Spacing @ 18mm (Downflow)
11. Plate Spacing @ 25mm (Upflow)
12. Plate Pack MTL 316SS or FRP

Upflow CPI

60° Up-flow Parallel Plate Separator designed and sized to remove and clean solids from wastewater.

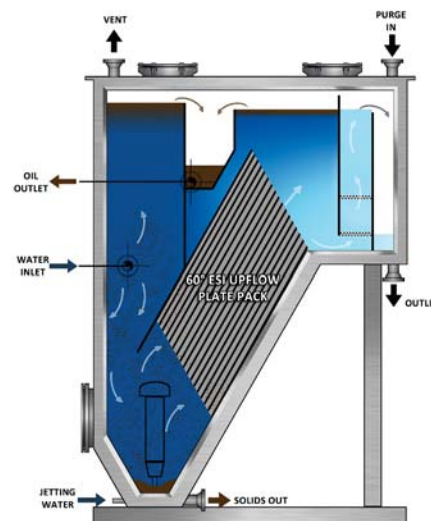


UPFLOW CPI

Principle of Operation

This ESI CPI separator is generally considered an "upflow" separator. The CPI "Pack" is designed to be installed and function at an angle of 60 degrees to the horizontal plane with plates spaced 25mm to minimize plugging. Water enters the inlet nozzle and distribution header low in the primary solids/sludge chamber. The heaviest solids/sludge settle in the primary chamber for discharge through the clean out nozzle. The contaminated liquid enters the bottom of the pack and flows upward. Solids accumulate on the plates and counterflows the waste flow to the bottom of the plates. The oil moves with the water flow to a level above the plates where a thick layer is allowed to collect until it overflows the adjustable V-notch oil weir into the oil collection chamber for removal. Treated water flows upward over a fixed water weir into the clean water collection chamber for removal.

This type of CPI can be fitted with a sand cleaner which uses high pressure water to blast the oil wet sand particles into a header where the oil is knocked loose from the sand.



Vertifloat CFU

Compact and reliable, our VertiFloat® Compact Flotation Unit purifies wastewater using 2-stages of oil droplet coalescence along with a single flotation compartment, thus conserving precious deck space and weight.



VERTICAL FLOTATION

FLOTATION DEVICES ARE USED AS A FINAL POLISHING STAGE

Flotation devices are designed to remove (or polish) the most difficult contaminants from the produced water - small droplets of oil and small, oil-coated solids. As such, flotation equipment is subject to the following general limitations:

Percent removal of contaminants:

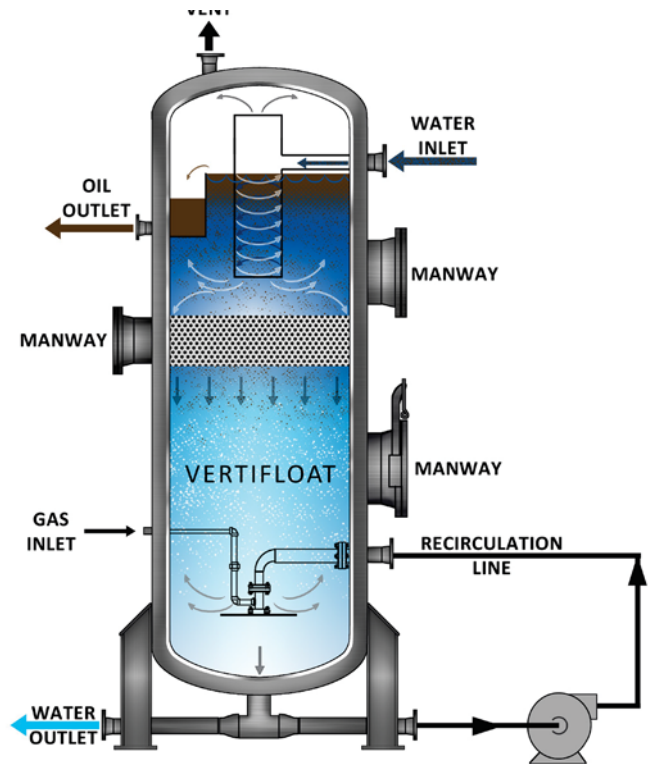
One-cell IGF: 50-90%

Inlet contaminant concentration:

One-cell IGF: 200 mg/l, max (<100 mg/l preferred)

Key Features of Vertifloat™ CFU, Design:

- Designed primarily for floating platforms or fixed platforms with limited deck space
- Lowest downward fluid velocity (0.5 m/min.)
- Process 30% over design flow rate
- Produced Water Inlet releases gas slugs avoiding upsets in the oil pad
- Distributes water evenly over the vessel's cross section
- Triple stage oil droplet coalescence
- Precoalesces oil in water inlet through centrifugal force
- ESI Matrix™ coalescing media installed for second stage separation
- Specially designed effluent nozzle prevents fluid short-circuiting
- Standard chemical injection system efficiently disperses high MW flotation polymers



Quadair IGF

The Quadair® IGF is designed to break emulsions by means of flotation and purifies wastewater using a multi-compartment system that conserves space and keeps costs down.



QUADAIR IGF

Quadair Flotation Unit

The ESI Quadair Induced Gas Flotation Unit is designed and engineered to remove oil emulsions, suspended solids and organic materials from wastewater. The Quadair requires minimal operating power, uses less floor space and has low installation and maintenance costs. Standard Quadair units are available (see sizing table) & ESI can design special models to meet specific needs.

Operating Principles

The ESI Quadair IGF is divided into six compartments: an inlet distribution compartment (1), four flotation compartments (or cells) (2), (3), (4), (5) and a clean water outlet compartment (6). Each compartment is separated by a pair of over/under baffle plates (7), which prevents short circuiting.

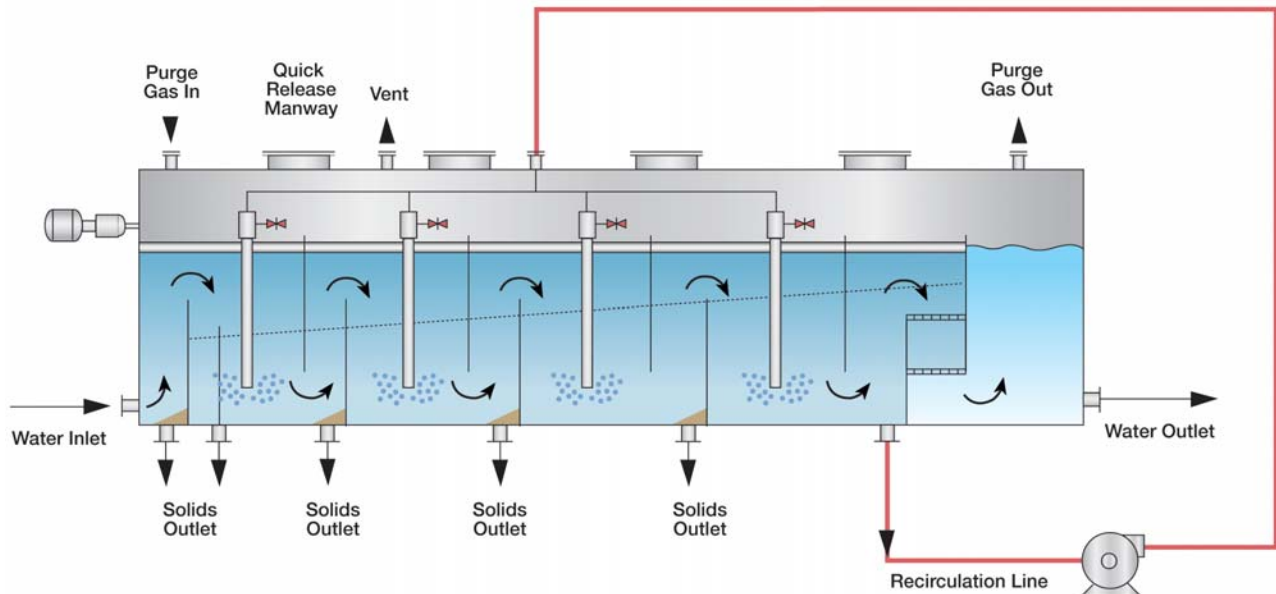
A centrifugal pump (8) recirculates the clean water through a header to an eductor (9) in each flotation cell. Recirculation rate is 50%-125% of the total throughput. The ESI's Quadair IGF can be equipped with one recirculation pump or with an additional standby pump.

A gas blanket (10) (1-2 oz/sq2) is maintained above the water level to help saturate the liquid. As the recycled water passes through the venturi-type eductor, it creates a slight vacuum, pulling gas into the eductor nozzle. Gas flows through a 1/2" line into a stainless needle valve controlling the amount of gas entering the flotation cell. By controlling the gas induced, the proper bubble size and pattern for efficient lifting of suspended solids and oils is achieved.

Oil and suspended solids create a froth on the liquid surface where they are continuously removed by means of adjustable v-notch weirs, rotating wiper blades or rotating pipe skimmers. The average skim rate ranges from 1-3% of the total liquid throughput and the residence time is approximately 5 minutes. All Quadair IGF's meet API's RP 14C and can usually achieve 90-97% efficiency due to the combined features of the baffle configuration, recirculation rate, eductor design and gas volume adjustment.

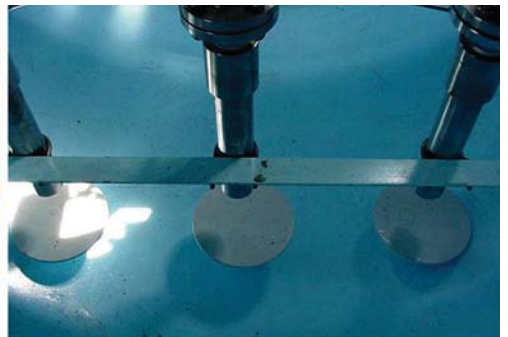
Quadair Features:

- Cylindrical Configuration.
- Four Cells.
- Over and Under Welded Internal Baffles.
- Single, Dual or Multiple Eductors per Cell with Needle Valve.
- Dual Reject Troughs with Three Skimming Options.
- Inlet and Effluent Sample Points.
- Internal and External Painting System.
- Dual Recirculation Pumps with Associated Valves and Piping.
- Controlled and Instrumented per Specifications.



ESI QUAD-INDUCED IGF MODEL NUMBER SELECTION CHART

MODEL NUMBER	FLOWRATE		3/60/440 MOTOR HP	APPROXIMATE SKID SIZE			APPROXIMATE WEIGHT	
	GPM	BWPD		L	W	H	DRY	WET
QH-5	146	5,000	5	15'-0"	6'-0"	6'-9"	8,000	15,000
QH-10	292	10,000	7.5	15'-6"	6'-9"	7'-0"	10,000	24,000
QH-15	438	15,000	15	20'-0"	8'-6"	8'-0"	12,000	35,000
QH-20	593	20,000	20	20'-6"	9'-0"	9'-0"	15,000	42,000
QH-25	729	25,000	25	20'-6"	10'-0"	9'-9"	18,000	50,000
QH-320	875	30,000	25	21'-6"	10'-9"	10'-0"	25,000	78,000
QH-40	1,167	40,000	35	24'-0"	13'-6"	10'-0"	35,000	125,000
QH-50	1,458	50,000	50	23'-0"	14'-0"	12'-"	40,000	140,000
QH-75	2,188	75,000	75	25'-0"	16'-0"	13'-0"	45,000	160,000
QH-100	2,917	100,000	100	33'-0"	18'-0"	14'-0"	50,000	180,000



Skim Pile®

Our Skim Pile®/Open Drain Caisson treats deck drains for strictly regulated applications with an Intermittent Flow utilizing multiple baffles, oil risers and separating oil from water and sand.



SKIM PILE

SKIMPILE ≥50 MICRON (Intermittent Flow)

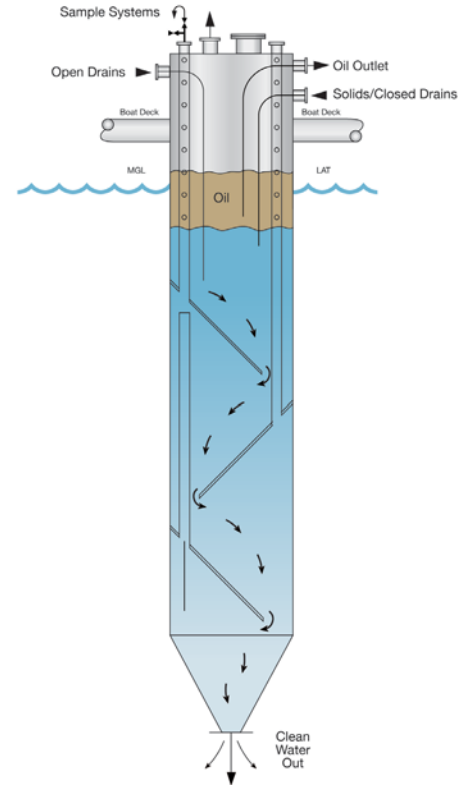
Open & Closed Drains intermittently enter the caisson. As the liquid flows down the caisson, it enters a baffled section (typically starting at EL (-) 20'-0" LAT). The baffles are spaced equivalent to the caisson diameter and this section is where the oil/water separation occurs. There are many advantages to the tightly spaced baffles:

1. Allows a shorter distance for free oil droplets to rise.
2. Creates a quiescent zone under each baffle allowing optimal conditions for oil/water separation.
3. Greater surface area for oil to collect and coalesce.
4. Cleans sand as it tumbles and rolls down the baffles.

Meanwhile, oil risers prevent the remixing of coalesced oil with the downward flow of water. Based on an intermittent flow of 2"/hr. rainfall for 20 minutes, ESI guarantees the removal of all free oil larger than 50 microns.

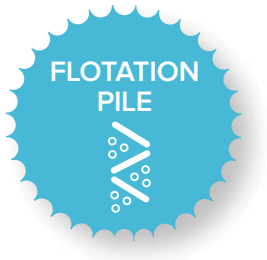
SKIM PILE ≥500 MICRON (Continuous Flow)

If the specification requires a continuous flow, then the caisson diameter must increase. This allows the larger oil droplets (≥500 micron) to rise faster than exiting velocity. The baffles are typically spaced every 20 feet and only extend to the center of the caisson. This also aids in reducing the downward velocity. Oil risers are used to prevent re-mixing oil with the water.



Flotation Pile®

The multi-process Flotation Pile® treats deck drains for strictly regulated applications with a Continuous Flow by utilizing baffles, oil risers and gas sparger flotation, resulting in the best separation technologies in one Offshore Caisson.



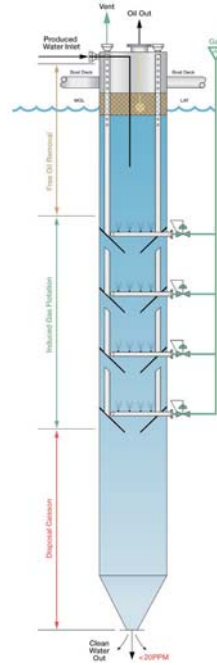
FLOTATION PILE

FLOTATION PILE ≥20 MICRON (Continuous Flow)

ESI's Flotation Pile enhances separation and saves platform deck space by combining topside flotation with underwater gravity separation. It is used primarily for processing improvements to the Skim Pile and when Produced Water is introduced into the Pile.

System Benefits:

- Multiple Processes in one Vessel
 - Free Oil Removal
 - Induced Gas Flotation
 - Disposal Caisson
- Minimum Deck Space Required
- Low Maintenance
- Solids Cleaning and Disposal
- Proven Technology
- Guaranteed Compliance to Governmental Discharge Regulations



Disposal Pile®

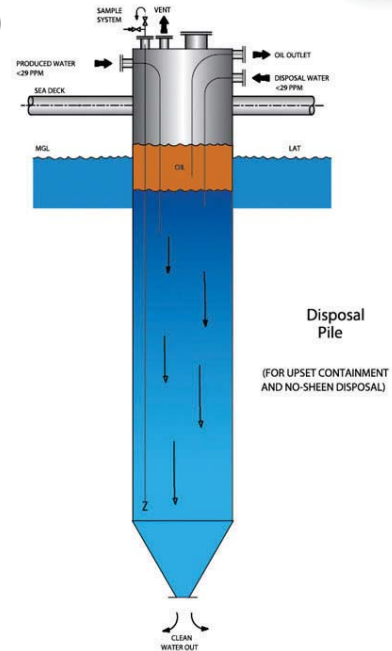
This underwater disposal system is a final discharge point for pre-treated Produced Water and is designed to contain any upstream upsets preventing unnecessary discharge violations.



DISPOSAL PILE (FOR DISPOSING OF PRODUCED WATER)

There are many reasons why a disposal caisson is vital to all platforms:

- Contains Produced Water upsets and prevents out-of-compliance fines.
- Disposes produced water below sea-level. Produced Water can sheen with as little as 5ppm of free oil if dumped overboard during certain conditions.
- Keeps produced water separate from oxygenated open drains, preventing scaling and other future problems.



Sampling System

SUMP CAISSON GAS LIFT SAMPLING SYSTEM

Since sampling is recommended by the API, EPA and SPE, ESI offers a Gas Lift Sampling System to get an accurate effluent water sample. This will determine if the caisson is working properly or maintenance is required.

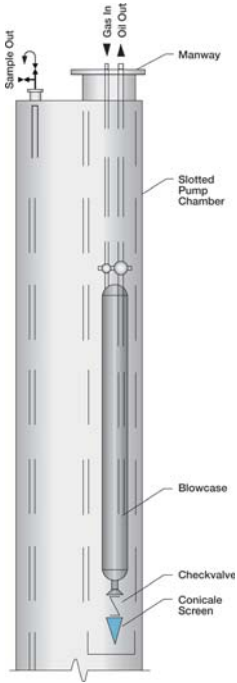
Oil Removal

Compare these oil removal solutions for cleaner water and low maintenance costs.

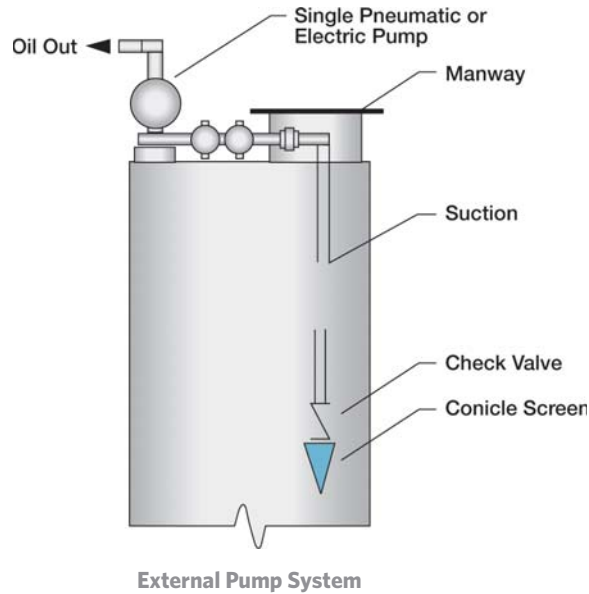


SUMP CAISSON OIL REMOVAL

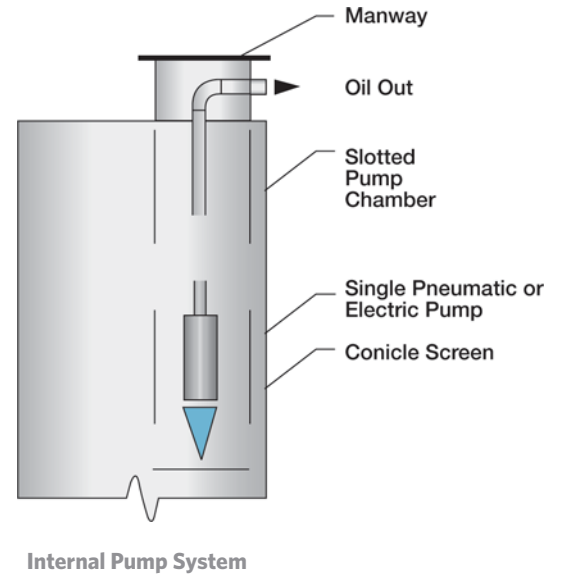
Below are three Oil Removal Solutions:



Blowcase System



External Pump System



Internal Pump System

INTERNAL BLOWCASE

MODEL NUMBER	MAX FLOW	DIAMETER	"L" S/S	N1 OIL INLET	N2 OIL INLET	N3 GAS INLET
BC-8	20	8"	120	2	2	1
BC-10	25	10"	120	3	3	1
BC-12	29	12"	120	3	3	1

PNEUMATIC PUMPS

MODEL #	MAX FLOW	MAX PRESS.	"L"	"W"	"H"	N1	N2	N3	"W"(lbs)
SPP-4	50/td>	100	2.25	1.50	2.33	1 1/2"	1 1/2"	3/8"	110
DPP-4	50	100	3.50	3.00	2.33	1 1/2"	1 1/2"	3/8"	220
SPP-8	100	100	2.50	1.68	3.08	2"	2"	1/2"	150
DPP-8	100	100	4.33	3.33	3.08	2"	2"	1/2"	300

Contact Us



USA LOCATIONS

① **ESI Corporate Headquarters:**
20333 State Highway 249
Suite 200
Houston, TX 77070

① **ESI R&D Facility**
6766 Bourgeois Rd.
Houston, TX 77070

Office: (281) 251-0569 • Fax: (281) 257-2310
sales@energyspecialties.com



WORLDWIDE LOCATIONS

② **Kuwait**
Target International Trading Est.
Souk Al Wataniya, Office #418, 4th Floor
Kuwait

③ **EMDAD LLC**
Abu Dhabi, UAE
P.O. Box 4118
Abu Dhabi, UAE

④ **Saudi Arabia**
Rezayat Trading Company Limited
P.O. Box 90, Al-Khobar, 31952
Kingdom of Saudi Arabia

⑤ **India**
SK Oilfield Equipment Co Pvt Ltd
26 Tarun Bharat, Chakala,
Andheri East, Mumbai 400 099
India

⑥ **Vietnam**
Alpha ECC, Southern Petroleum Construction
J.S. Company
Dong Xuyen Industrial Zone, Rach Dua Ward
Vung Tau City, ST Vietnam

⑦ **South Korea**
Kyungmaek Trading Corporation
Union Center Building, Suite 602
#837-11, Yeoksam-Dong
Kangnam-Ku, Seoul, South Korea

RFQ Form

COMPANY INFORMATION:

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Company _____ Phone _____
Address _____ Fax _____
Engineer _____ E-mail _____

SKIM PILE INFORMATION:

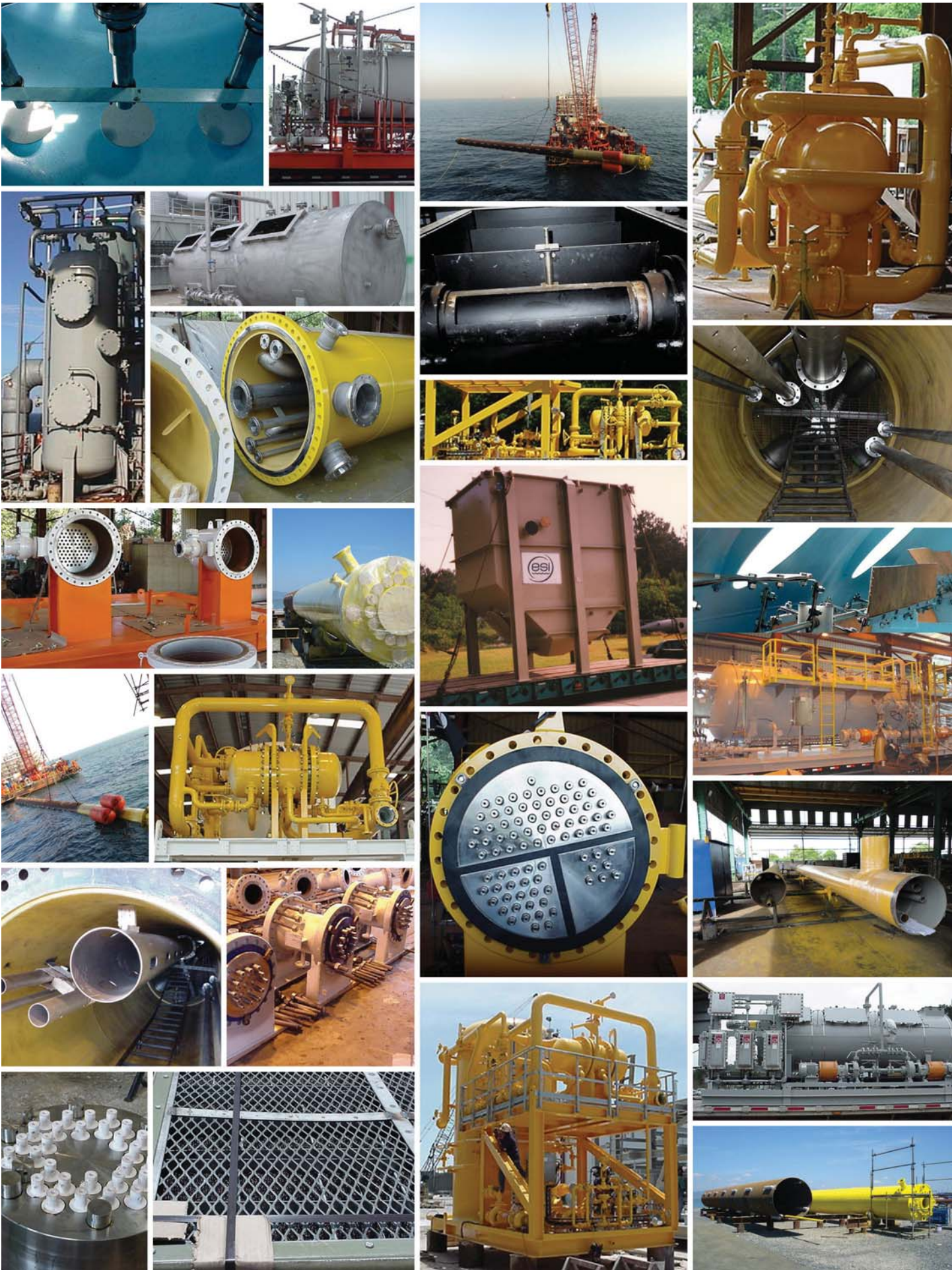
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Deck Area _____ Water Depth _____ Rainfall Intensity _____
Cellar Deck El _____ Boat Deck El _____ Continuous or Intermittent Flow _____
Oil Droplet Size In _____ micron Inlet Quality _____ ppm Effluent Quality _____ ppm

PRODUCED WATER INFORMATION

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Flowrate (bwpd) _____ Temperature: Operating _____ Design _____ °F
Oil Droplet Size In _____ micron Pressure: Operating _____ Design _____
Oil Viscosity _____ Water (SG) _____ Oil (SG) _____
Inlet Quality _____ ppm Desired Effluent Quality _____ ppm



CONTACT US

Want more information? Call or Email us today! A local sales representative will be happy to talk to you about all of your wastewater treatment needs.

ESI Corporate Headquarters

20333 State Highway 249
Suite 200
Houston, TX 77070

Office: (281) 251-0569 • Fax: (281) 257-2310
sales@energyspecialties.com

www.energyspecialties.com

ESI R&D Facility

6766 Bourgeois Rd.
Houston, TX 77070

