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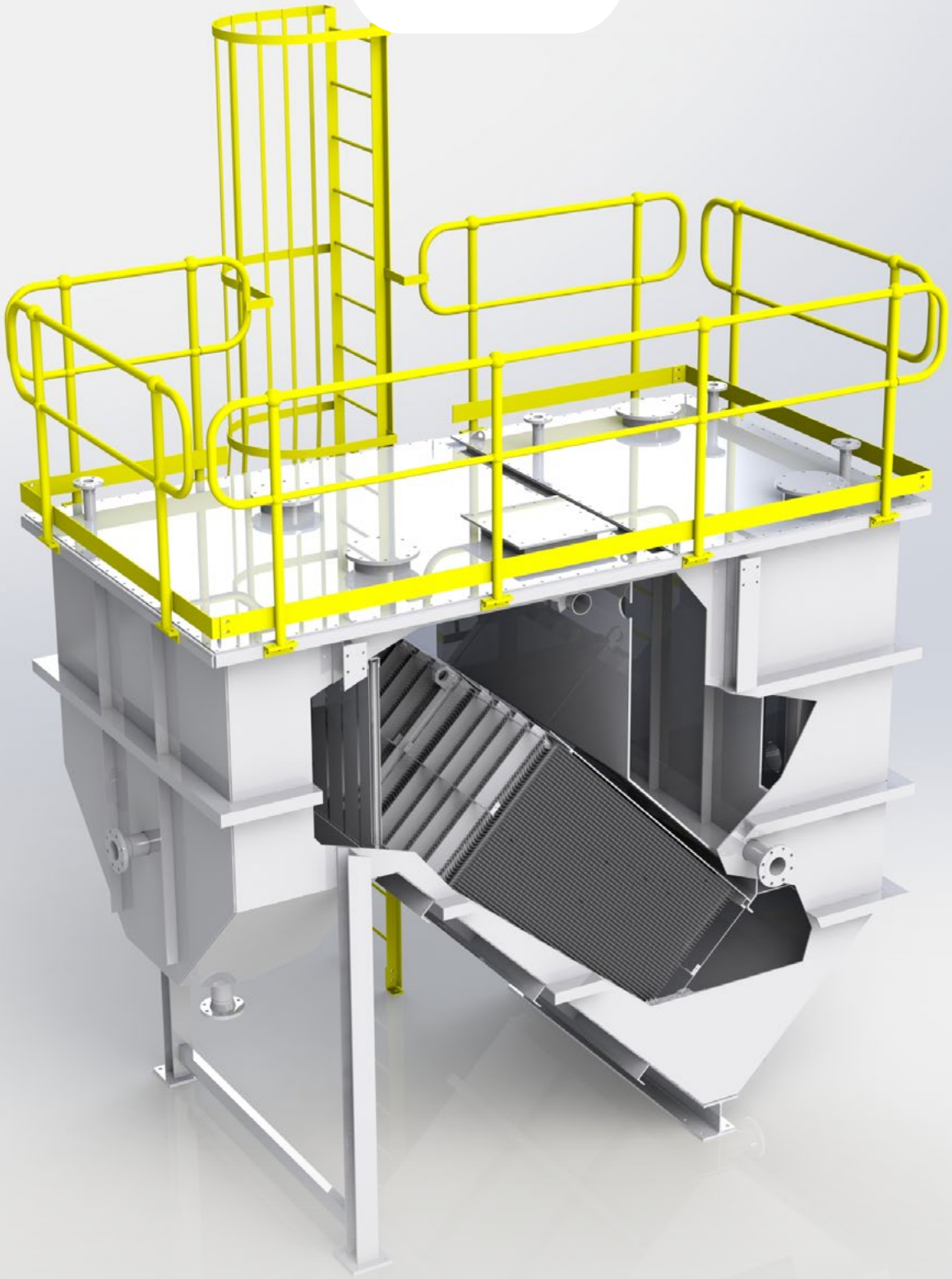


TiPSS TECHNOLOGY

Corrugated Plate Interceptor

WATER TECHNOLOGIES

Corrugated Plate Interceptor system for the gravity separation of oil from oily effluents

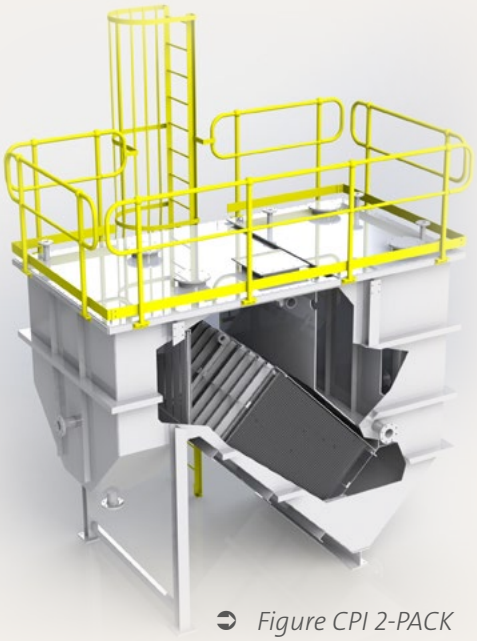
Based on Shell DEP 34.14.20.31

Advantages of the CPI system

- no moving parts
- high separation efficiency
- compact construction gives great economy in space and foot print
- low installation costs on site since units can be prefabricated
- minimum maintenance and operation costs
- uniformity in design guarantees quick delivery of unit and spares
- short hydraulic retention time
- continuous operation
- insensitive to weather conditions and variations in capacity, temperature and water characteristics
- resistant to shock and slug loads.

Typical removal rates

- oil globules cut off diameter: 10 – 60 µm and larger
- oil removal 50 – >99%
- residual 5 – 20 ppm slop oil
- TSS removal 80 – >90%



➲ *Figure CPI 2-PACK*

Applications

Tank Farms
- Ballast water
- Run-off surface water

Refinery
- Run-off surface water
- Waste water effulent streams
- In-process flows
- Produced water (on and offshore)

Petrochemical
- Run-off surface water
- Waste water effluent streams

Airport
- Run-off surface water
- Oil leakage water

Introduction

Gravity separation is the most straightforward method of effluent treatment and is, therefore, utilised widely in industry for the separation of settling and/or flotable impurities from a carrier liquid. In the majority of cases the separators are constructed in the form of a rectangular tank.

The effectiveness of such a tank depends theoretically upon its net separation surface (A) and the amount of water to be treated (Q). The ratio Q/A is called the overflow rate. The rising or settling velocity of a discrete particle with a diameter d can be indicated by Stokes' law:

$$V_s = \frac{200g \cdot (\rho_{liquid} - \rho_{particle}) \cdot d^2}{\mu}$$

Vs = sedimentation (floating) velocity [m/h]

g = gravity constant [m/s²]

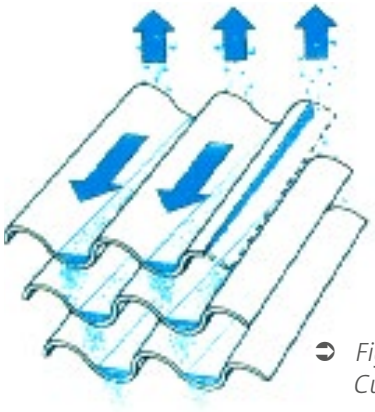
p = density phase [kg/m³]

d = particle / droplet diameter [m]

μ = dynamic viscosity [kg/m.s]

All particles or droplets having a settling or flotation velocity Vs>Q/A are fully intercepted, while a portion of the smaller particles will be captured also in a ratio of $(d/ds)^2 \times 100\%$.

An enlarged separating surface can be achieved by placing various smaller planes on top of each other in the tank. If these planes are subsequently inclined in a tilted position, material separated between the plates is removed by the gravitational force. This is the principle on which the CPI corrugated plate pack is based.



➲ *Figure Counter Current Separation*

In this plate pack the planes as referred to have been constructed in the shape of corrugated plates. They promote both the coalescence of the intercepted oil particles and, at the same time, their transfer through the plate pack (see fig. 1).

If settleable material is present in the liquid, such material is collected and concentrated in the troughs of the corrugations so that it will slide down in the plate pack smoothly and easily.

Very small separating diameters can be obtained in the CPI system, because the disturbing factors, such as eddies and turbulences, which adversely affect large conventional separating tanks (e.g. API's), are eliminated in the CPI.

➲ *Figure Detail Corrugated Plates*

Types and number of plate packs required

In formulating a design, the following minimum data are essential:

- the type of pollutants to be intercepted
- the separating diameter of the oil droplet
- the difference in density between the carrier liquid (waste water) and the pollutants to be intercepted
- the maximum amount of water to be treated
- the water temperature
- the sedimentation velocity
- origin of the oily liquid
- physical data, chemical analysis of carrier phase.

Subsequently the required separating area (A) is computed with:

A = Q/Vs

The required number of plate packs are determined from this separating area.

Process flow description CPI system

Process flow description CPI system

With the objective of not breaking up the oil droplets unnecessarily, the CPI system is preferably fed by gravity. The oily water flows into the interceptor through the inlet compart-ment which has a dual function as a sand trap (1) and the coarse floating solids removal by a Bar Wedgewire. The inlet compartment can be used as emergency overflow or first flush basin. A double slotted baffle (3) induces incoming water to flow evenly and uniformly to the entrance of the corrugated plate pack (4). In the plate pack the oil droplets are intercepted and coalesce into large droplets.
They leave the pack rapidly in counter current mode and move upwards against the liquid flow, to the surface.
The separated oil builds up a floating layer (5) which is removed through a skim pipe (6).

Settleable material, if present in the aqueous phase, is similarly separated in the plate pack. It collects in the corrugated plate troughs and then slides down to the sludge compartment (8). The treated clear water leaves the plate pack at the bottom and is discharged over an adjustable weir (7).

To reduce fire hazard and odours to a minimum, the system can be covered and gas blanketed.

The amounts of oily water to be treated can vary from some m³/h to many thousands m³/h. In order to effectuate quick delivery of complete plants for the required amount of waste effluent, Veolia Water TiPSS Technologies produces corrugated plate packs in various sizes for different capacities.

CPI Separator Plate Pack capacities

Type	Capacity m³/ h	
	Process (COC)	Surface run-off (AOC)
1 (Single) pack	30	60
2 (Twin) pack	60	120
1 Magnum pack	45	90

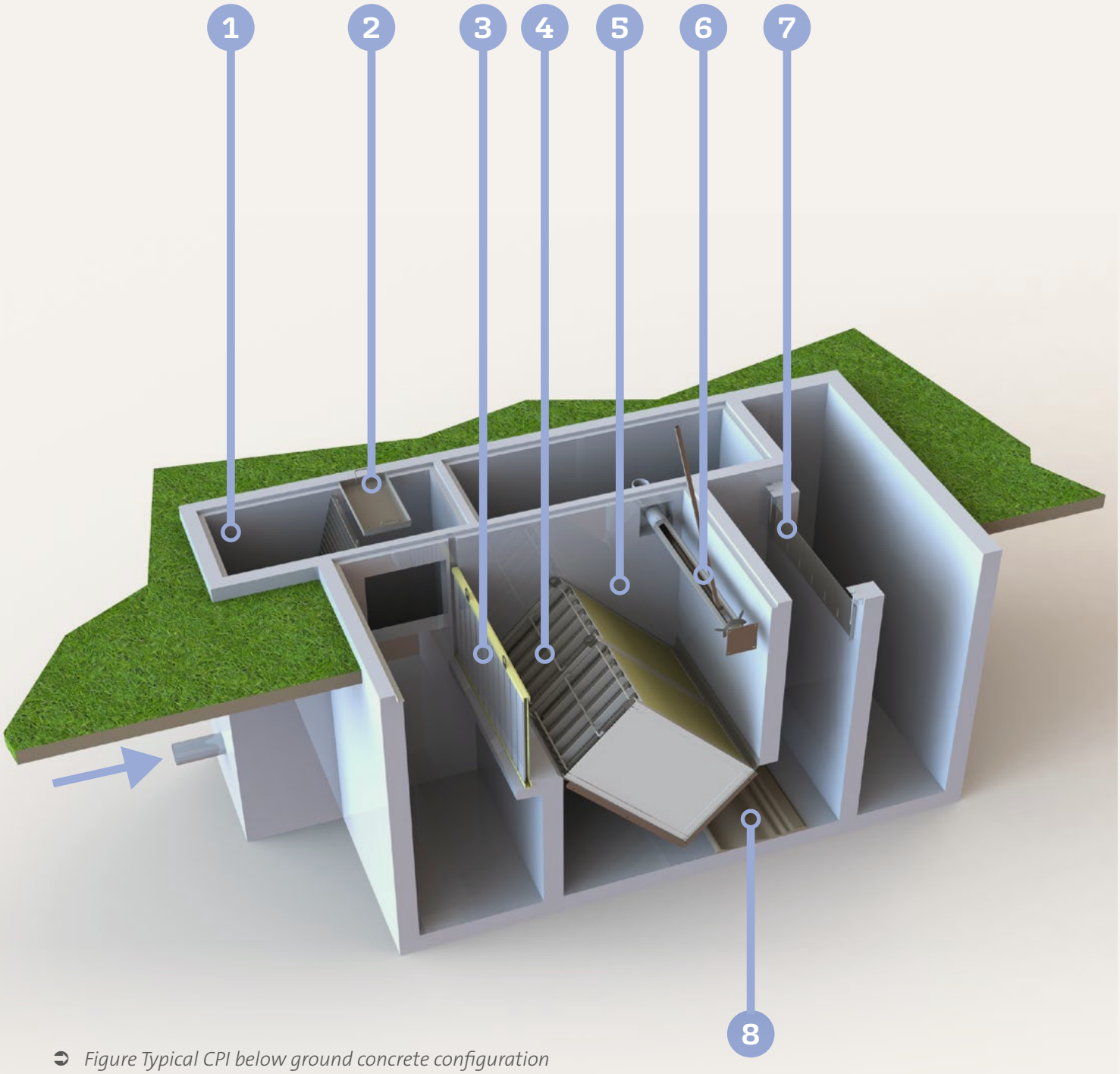
Many hundreds of complete, advanced wastewater treatment plants have been put into operation throughout the world.

The compact design and the high separating efficiency versus low investment and maintenance costs which are so characteristic for this gravity separator system, have proven their value in practice.

Design

Each effluent stream has its own individual characteristics; the impurities in the aqueous phase can occur either as a dispersion, an emulsion or a solution and the particle size distribution differs from case to case. For this reason, specific process analyses and design calculations must be made for each case.

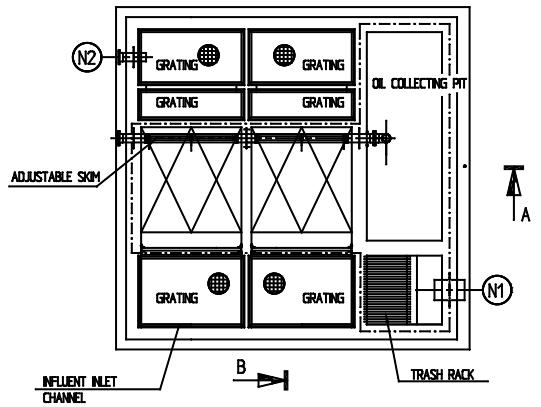
It is however fundamentally impossible to separate dissolved or emulsified components from the aqueous phase by means of gravity only.

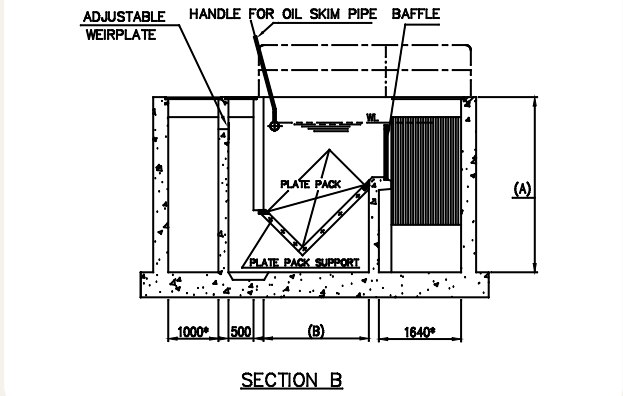


➲ *Figure Typical CPI below ground concrete configuration*

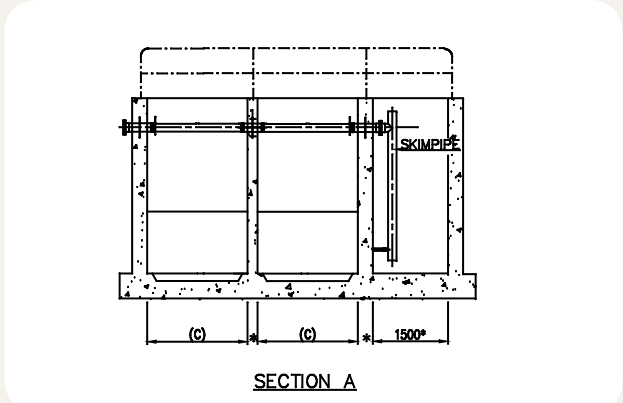
Reinforced concrete execution

TYPE	Dimensions		
	A mm	B* mm	C mm
1 pack CPI	3500	2100	1000
2 pack CPI	3500	2100	2000
3 pack CPI	3500	2100	3000
4 pack CPI	3500	2100	2 x 2000
6 pack CPI	3500	2100	2 x 3000





SECTION B

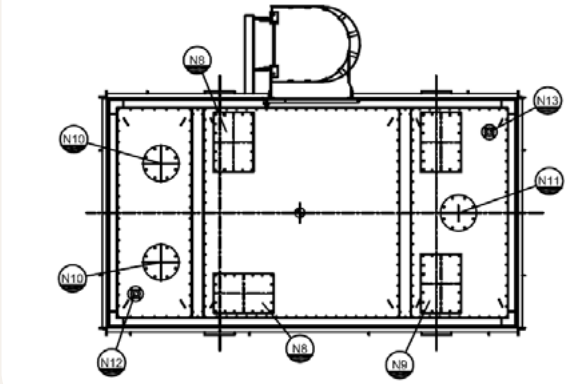


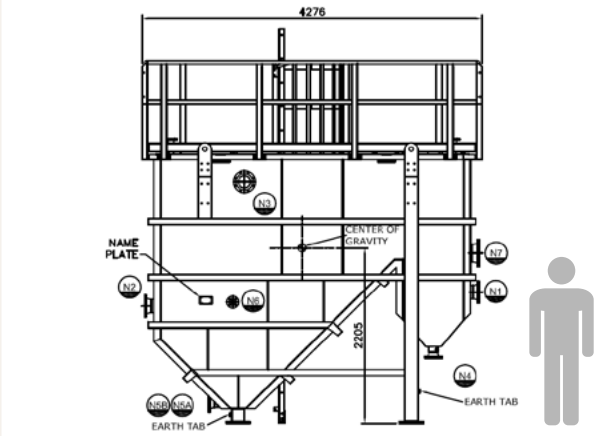
SECTION A

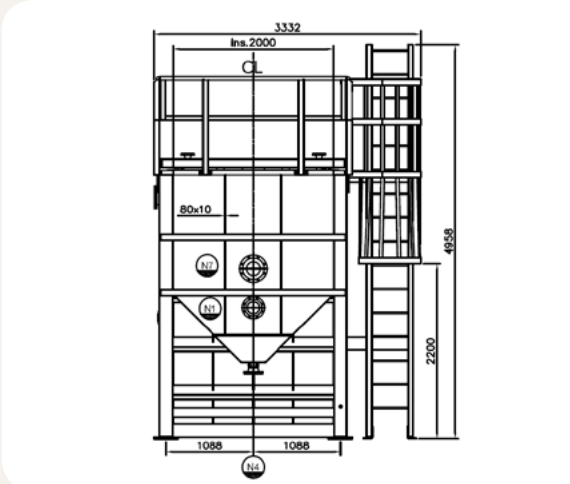
B: separation compartment only. The overall length (composed of inlet, oil and outlet compartment) varies upon specific customer requirements, true capacities and site conditions.*

Steel execution

TYPE	Dimensions		
	A mm	B mm	C mm
1 pack CPI	3200	3200	1000
2 pack CPI	3200	3200	2000
3 pack CPI	3200	3200	3000
4 pack CPI	3200	3300	4000
6 pack CPI	3200	3300 (6600)	6000 (2 x 3000)
8 pack CPI	3200	3300 (6600)	8000 (2 x 4000)







Examples of applications

Refinery effluents

Refinery effluents, classified as AOC/COC (Accidentally Oil Contaminated / Continuously Oil Contaminated) effluents, originate from the following sources: oily surface run-off (rain) water, fire fighting, tank bottom-, equipment-, and desalter drains and process water. Above effluents are properly (pre-) treated via CPI gravity separator. Above streams are directed to a CPI unit to segregate sand and free and separable oil. Depending on the onsite requirements, further treatment can be carried out via a flocculation-flotation unit or subsequently a biologic polishing plant. Rain and fire fighting waters are optimally treated separately due to their large quantities and dispersed oil contamination.

Airport stormwater treatment

Airport surface runoff water originate from the following sources: oily surface run-off (rain) water, fire fighting, equipment-, and drain water.

Above effluents are properly (pre-) treated via CPI gravity separator. Above streams are directed to a CPI unit to segregate sand and free and separable oil.

Depending on the requirements, further treatment can be carried out.

Services

Veolia TiPSS Technologies is a (Waste) Water Treatment specialist with expertise in Oil & Gas industry complying engineering and fabrication. To ensure projects comply with client specification we use our quality management system (ISO 9001 certified) and additional quality documents like dedicated Project Execution Plan and Quality Plan. For competitive reasons we are able to outsource manufacturing of the tank near client location. The worldwide coverage of the Veolia Water network ensues the client of local support.

From single units to turnkey projects

The CPI separator can be combined with other Veolia Water TiPSS Technologies or Veolia Water Solutions & Technologies systems to improve the quality of the effluent or process water to e.g. comply with the requirements set forth by the authorities or company prescriptions:

- DAF separation of flocculated impurities by flotation and chemical pretreat-ment
- PCS / MMF Walnut Shell Filters / Multi Media filters
- MBBR/MBR Mixed Bed BioReactor or Membrane BioReactor

For further detailed information please enquire at our office.

The Veolia Water TiPSS Technologies scope of work can be:

- turnkey deliveries
- recommendations
- design
- engineering
- erection
- installation, commissioning and start-up
- after sales service
- laboratory and field research
- pilot plants

Resourcing the world

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