

SLOTTED PIPE SKIMMER

Each Hudson Industries rotating drum skimmer can be uniquely engineered to meet customers' exact specifications.

INDUSTRIES SERVED

Hudson Industries has engineered systems and equipment for major corporations throughout the world. Providing products and services that are trusted by organizations including BP, Amoco and NASA.

- Offshore / Onshore Oil and Gas
- Water / Wastewater Treatment
- Power Generation
- Petrochemical
- Steel Manufacturing
- Pulp and Paper
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- General Heavy Industry
- Food Processing

PRINCIPLE OF OPERATION

Oil and water by their nature are immiscible (describes two or more liquids that will not mix together to form a single homogeneous substance), this fact, along with the difference in density that exists between oil and water, leads to the oil, lower density, rising to the top of the tank. The oil separates according to Stoke's Law, which defines the terminal rise velocity of a given size of oil droplet:

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Slotted Pipe in Tank of Untreated Water

$$V_r = g d^2 (\rho_w - \rho_o) / 18 \eta$$

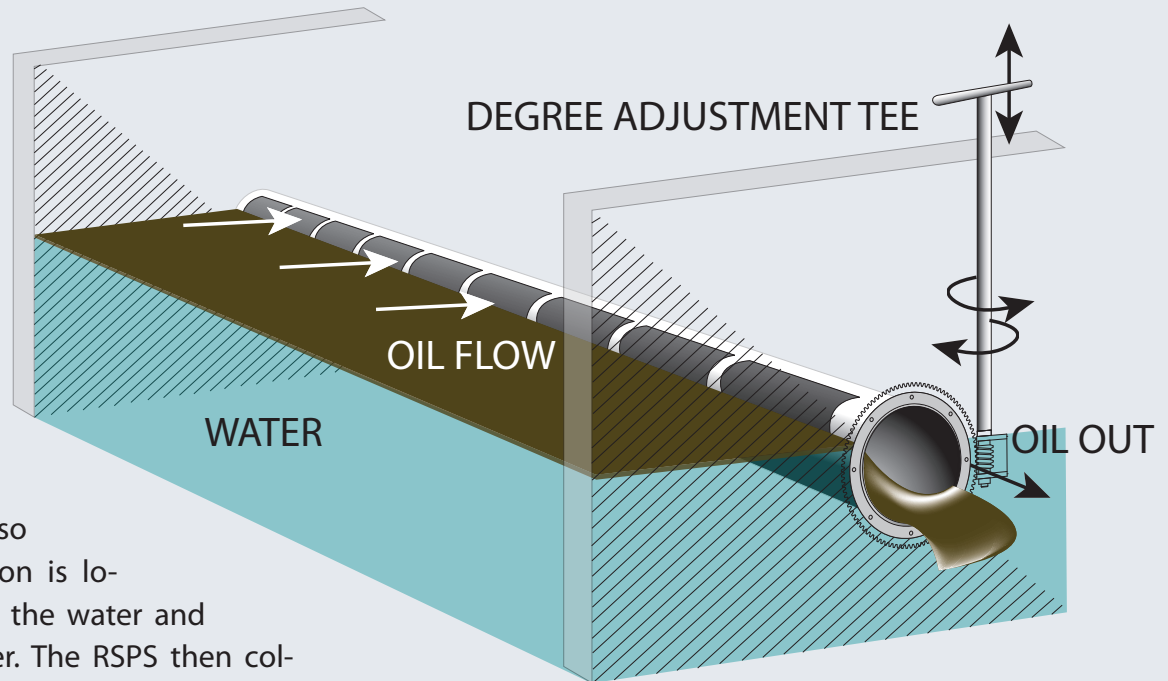
V_r = rise velocity of oil droplet
 g = acceleration due to gravity
 ρ_w = density of water
 ρ_o = density of oil
 d = oil particle diameter
 η = viscosity of water

The oil will form a layer above the water surface that can be separated from the water by skimming action. The Rotatable Slotted Pipe Skimmer (RSPS)

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is the simplest and most economical method available and is used extensively in municipal and industrial wastewater installations.

The RSPS is located at the end of the Separation Bay. The RSPS is rotated manually or by motor operation so that the slotted section is located $\frac{1}{4}$ " to $\frac{1}{2}$ " above the water and located in the oil layer. The RSPS then collects the oil under weir flow conditions. When the RSPS's slots are rotated backward, the skimming temporarily ceases.



DESIGN

The RSPS is capable of spanning the width of the tank bay with maximum deflection limited to $L/360$, or $1/4$ inch whichever is less (both with pipe empty and the pipe full) and allows a uniform flow of oil into the pipe along its entire length. L is defined as the unsupported product length, in inches.

60° slots are cut symmetrically about the top dead center of the pipe O.D. as viewed from the pipe cross section. The edges of the slots serve as a weir over which the floating oil flows into the pipe when the pipe is rotated to operating condition. The edges of the slot are cut parallel to the longitudinal axis of the pipe at regular intervals of not more than $2'-6"$ with a minimum $1\frac{1}{2}"$ wide bands of the full pipe periphery remaining in the pipe to act as stiffeners.

The RSPS is supported at each end and rotates in wall mounted bearings consisting of a Stainless Steel mounting plate that is welded to an adjustable Stainless Steel plate. A Stainless Steel cover plate encloses replaceable bearings which are made of UHMW or TFE material. The mounting plate may also contain Kevlar or O-Ring seals.

A suitable watertight seal (by installer) shall be provided between the rotating pipe and the wall mounted bearing. The seal is constructed so that the seal material is selected so that it is not affected by grease, mild acids, or alkalis.

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Wall Sleeves

A pipe wall sleeve (by installer) of the same diameter as the skimmer will be cast in the wall, where required, to permit flow between adjacent skimmers and discharge from the tanks. Each sleeve will have an intermediate flange. Sleeves will be provided by the mechanical contractor.

AVAILABLE SKIMMER OPERATOR STYLES

Hudson RSPSs are available in four basic styles: lever operated; rotating handle with worm and worm gear operation; rotating handle with sprocket and chain operation; and motor driven lever operated complete with a level control and limit switches for rotational limit of the slotted pipe. The RSPS pipe is made of Stainless Steel Construction.

Lever Operated

The RSPS can be manually operated by means of handle or lever that is attached directly to the slotted pipe O.D. The bearing ends are lubricated using a "Zirk" style fitting located at the edge Separator Bay adjacent to the skimmer. It is possible to rotate the pipe a minimum of 90 ° in either direction from the "off" position where the slot is at top dead center.

Hand Wheel with Worm Gears

The RSPS is manually rotated by means of a rack and pin worm gear using a shaft and hand wheel mounted on a bracket at the edge of the Separator Bay. Gears and bearing ends are lubricated using a "Zirk" style fitting located at the edge of the Separator Bay adjacent to the skimmer. Gears are manufactured of Bronze or Stainless Steel for long life and wear resistance. It is possible to rotate the pipe a minimum of 90 ° in either direction from the "off" position where the slot is at top dead center

Hand Wheel with Sprockets

The RSPS is manually operated by means of a sprocket and chain using a shaft and hand wheel mounted on

a bracket at the edge of the Separator Bay. The chain and sprockets are manufactured of Stainless Steel for long life and wear resistance. It is possible to rotate the pipe a minimum of 90 ° in either direction from the "off" position where the slot is at top dead center

Motor Driven Lever Operated

The RSPS is driven via a motor/actuator/linkage system. Each drive unit will consist of a drive motor a minimum of NEMA "B," totally enclosed fan cooled; a right angle gear reducer; an actuator arm and linkage; limit switches, motor starters, and control panel. The RSPS will be capable of rotating in any position within 45 degrees in one direction to 45 degrees opposite. The system can be equipped to operate based on a level switch, if required. Actuator arm and linkage are of Stainless Steel Construction.

API SEPARATOR BAY

The API guidelines for the Separator Bay design criteria are: The typical API separator is a long, narrow, shallow tank. Design standards for the Separator Bay can be obtained from API Publication 421, "Management of Water Discharges: Design and Operation of Oil Water Separator."

The API design criteria including the following:

- Length = depth/rise rate x design horizontal velocity. The minimum length-to-width ratio is 5.0 : 1.0 to ensure that the operating allow adequate separation conditions, and to minimize the potential for short-circuiting in the unit
- The minimum depth-to-width ratio is 0.3 minimum to 0.5 maximum to ensure that the separation units are not excessively deep. This provision minimizes the amount of time needed for oil particles to rise to the surface.
- The maximum channel width is 20 ft; the maximum depth is 8 ft .

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- The horizontal velocity should be the smaller of 3 ft/min or 15 times the oil globule rise rate, to minimize turbulence so as to impede oil/wastewater separation
- Reaction jet baffles are recommended, to diffuse influent flows across the width and depth of the API separator. The baffles help minimize the effect of high wastewater inlet velocities, as well as the possible short-circuiting and decreased oil-removal

efficiency associated with such velocities

- API separators can remove oil particles of 150-micron size or larger. The size removal can however be adjusted to promote the removal of smaller oil droplets. If no adjustments are made, particles smaller than 150 microns will normally exit the separator with the wastewater, and will need to be removed by downstream treatment.



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