




**ROYTEC**  
Global Separation Solutions

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## ROYTEC PINNED BED CLARIFIER (PBC)

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**MARKET LEADERS IN  
LIQUID / SOLID SEPARATION**

# ROYTEC PINNED BED CLARIFIER (PBC)

**ROYTEC GLOBAL is an International Company specializing in Liquid / Solid and mineral Separation technologies for the Mining and Industrial sectors.**

Roytec is privately owned by Directors and Managers. We are passionate about excellence in our services and we pride ourselves in delivery to our promises. Our equipment is fully supported by Roytec Specialists based in Johannesburg, South Africa; Perth, Australia; Toronto, Canada; and Yantai, China.

## PINNED BED CLARIFIERS

The Pinned Bed Clarifier (PBC) offered by Roytec Global was developed following an extensive R&D programme, several years of pilot scale testing and numerous successful operating installations to produce a clarifier capable of achieving fluxes of 15 m<sup>3</sup>/m<sup>2</sup>/h with exceedingly high overflow clarities.

In the Roytec PBC, the solids in the feed are reduced from as high as 5000ppm down to 10-20ppm. The high solids handling capabilities and high overflow clarities are achieved in the Roytec PBC by using the highly efficient Radflow™ feedwell to pass the feed through the fluidized bed of sludge in the primary solids removal zone while minimising perturbation to prevent breakthrough. The fluidized bed acts as a filtration medium, as well as promoting further coagulation and flocculation.

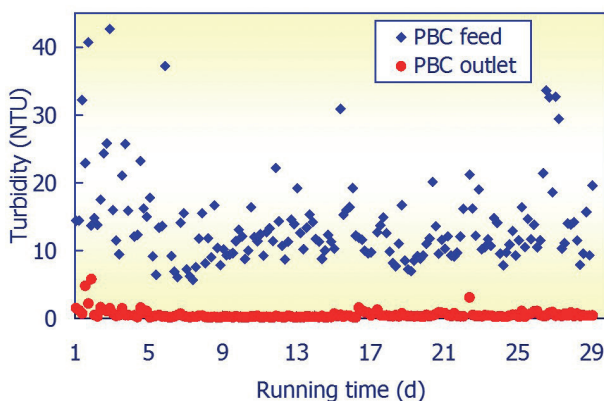


The development program showed that the primary separation zone performed the bulk of the solids removal. In most cases the solids were reduced to less than 50ppm. The floating media bed above the sludge blanket further reduced the solids to less than 20ppm.

Roytec's range of **PBC** has been specifically developed for the generation of high quality overflows from relatively high feed solids required for various process applications, which is not achievable using other conventional technologies such as sand filters.

## NOVEL OPERATING PROCESS

**Actual Base Metal Plant Data**



Roytec has developed a specific feed conditioning process for the pre-treatment of process streams that improves significantly overall clarifier performance. This process was developed based on extensive test work and pilot plant trials conducted at various sites, particularly Anglo American - Skorpion Zinc Mine in Namibia.

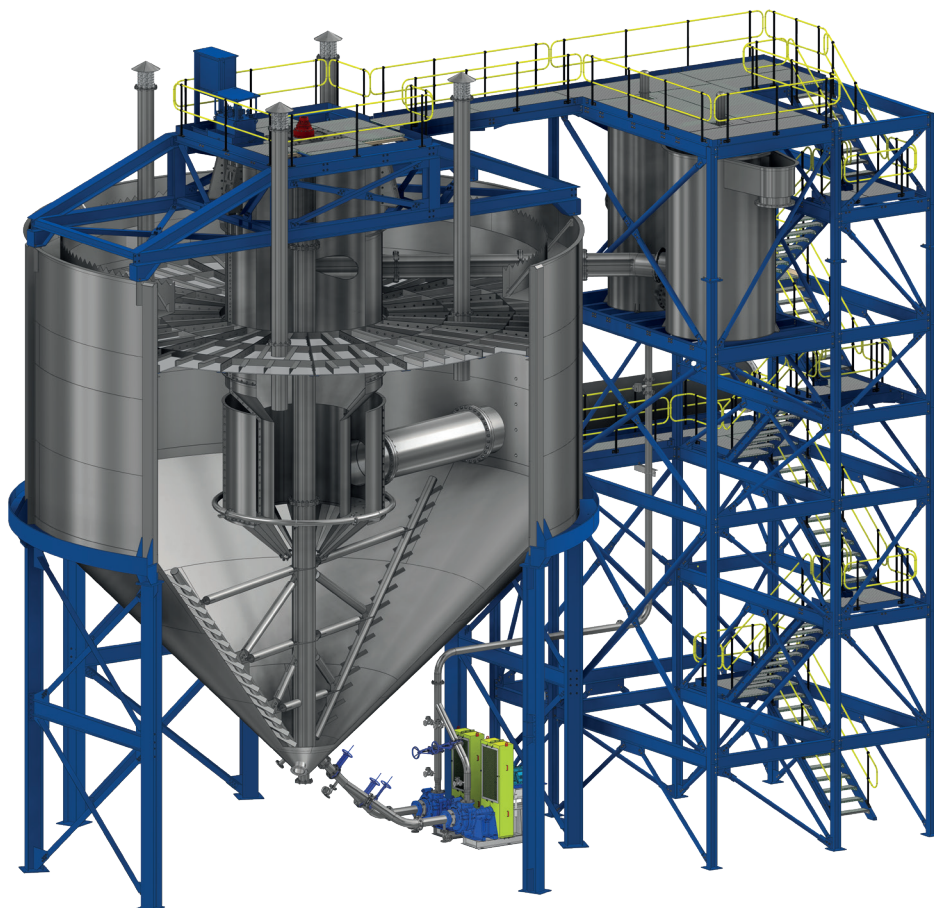
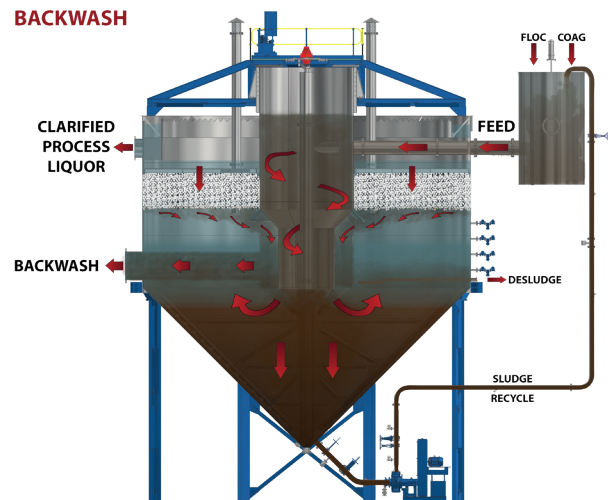
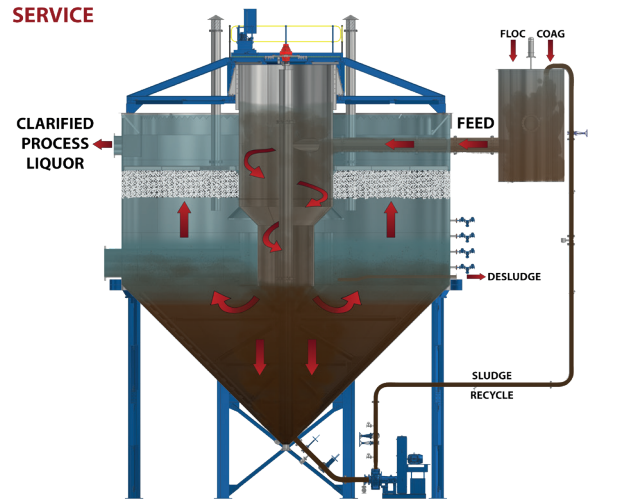
This process utilises **high and low energy mixing**, upstream of the PBC, and includes the dosing of coagulant and flocculant respectively. During trials with our pilot PBC unit over several months, feed to the unit ran at between 50 – 250 (even 500) ppm suspended solids with average overflow clarities of less than 10ppm obtained.

## PRINCIPLE OF OPERATION

The clarifier consists of a conical bottom tank with cylindrical sidewall equipped with a full-span bridge from which the internals are suspended. The primary solids removal zone comprises a feed pipe, feedwell and rake mechanism. The sludge bed is formed in this zone performing the primary solids removal. The outer annular area, between the feedwell and the cylindrical side wall, above the sludge bed forms an up-flow filter with media bed. The media is selected to float in the process liquor under normal operating conditions and is pinned against a wedge wire deck. During the service cycle underflow is withdrawn continuously from the recycle nozzles at the bottom of the cone section and returned to the conditioning tanks to seed the feed and promote floc formation.

The sludge bed level, critical for the operation of the primary solids removal zone, is maintained by withdrawing sludge from the desludge nozzle just above the joint of the cone section to the cylindrical shell. During the service cycle the media bed increasingly builds up with suspended solids removed from the feed and the level in the feedwell rises in proportion to the increased pressure drop across the loaded media bed. When the level in the feedwell reaches a pre-determined height, backwash is initiated using the clarified liquor inventory between the wedge wire deck and overflow weir in downflow to expand the bed and remove the accumulated solids through the backwash collection cylinder, pipe and valve.

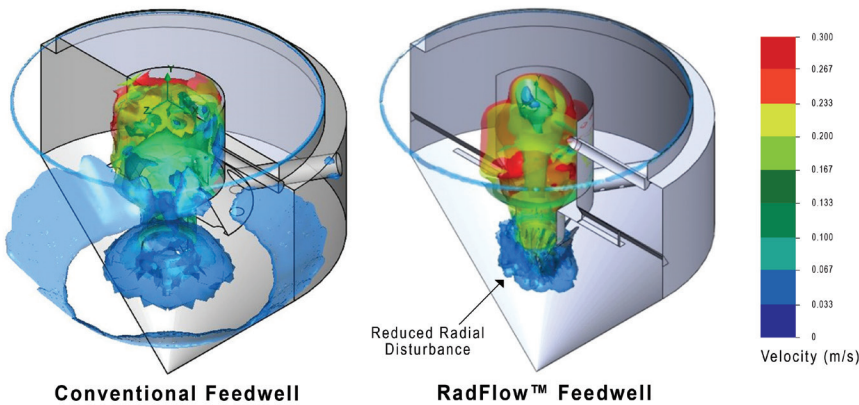
The backwash step is completed by closing the backwash valve when the level drops to the top of the wedge wire deck and the unit returned to service. The overflow of clarified liquor resumes when the level above the wedge wire deck reaches the overflow level.



## DESIGN FEATURES

The high solids removal efficiencies obtained in the Roytec PBC are achieved through a number of unique design features:

- Utilization of a coagulation and flocculation mixing system.
- Use of an inorganic coagulant to coagulate the ultrafine and colloidal material, and a flocculant is added to ensure fast sludge settling.
- Simple and effective sludge level control by withdrawal above the cone section using the de-sludge nozzle and pump without the requirement for instrumentation.
- Installation of an underflow sludge raking system to prevent hang-up of sludge in the cone area and rat-holing in the sludge bed for consistent underflow density.
- The installation of the world leading RadFlow™ feedwell technology developed for Roytec Thickeners. This feedwell effectively dissipates the energy in the feed and gives highly uniform radial distribution, which allows for 30 to 50% higher feed flows than conventional feed distribution systems. Fluxes of up to 15 m<sup>3</sup>/hr/m<sup>2</sup> are achievable using the RadFlow™ feedwell technology.

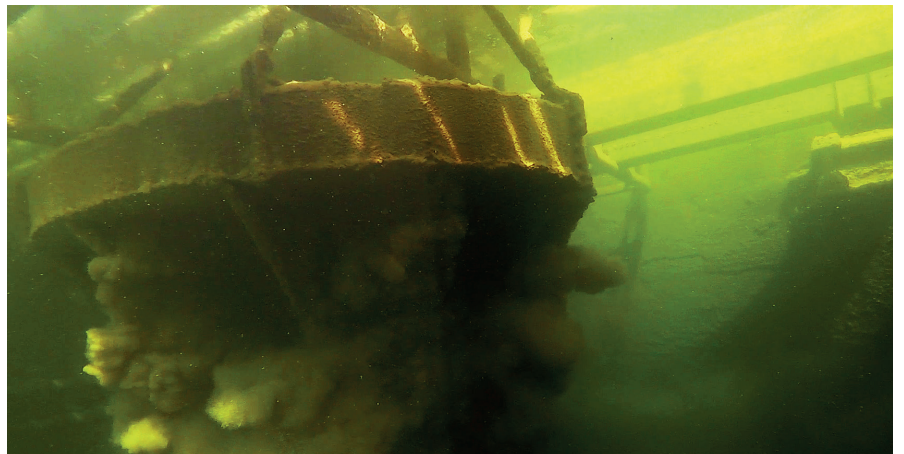


The CFD schematic (image to the left) indicates velocity isoprofiles for a conventional feedwell installed in a clarifier versus a RadFlow™ feedwell.

The improvement in energy dissipation of the RadFlow™ is translated into a significantly reduced velocity profile from the feedwell.

The image on the right shows the undisturbed, uniform column of sludge from a RadFlow™ feedwell installed in a retrofit clarifier at the Inco-Vale Goro Nickel plant. The clarifier was operating at 8 m<sup>3</sup>/hr/ m<sup>2</sup>, and the picture demonstrates the almost complete energy dissipation brought about by the RadFlow™.

The full scale operation indicates the accuracy of the modelling carried out in designing the system.



## POTENTIAL APPLICATIONS

Some of the potential applications of the PBC in the mining, mineral processing and hydrometallurgical industries are as follows:

1. PLS solutions clarification
2. Thickener overflow polishing
3. Process water clarification



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## Other ROYTEC equipment

- Vacuum Belt Filters & Vacuum Disc Filters
- Thickeners using RadFlow Feedwell Technology
- Dual Media Filters
- BGRIMM Flotation Cells, Magnetic Separators and Attritioning Mills
- Filter Presses & Tower Presses
- Ceramic Disc Filters
- Ion Exchange Systems
- Flocculant/Coagulant Preparation and Dosing Plants
- Linear Screens
- Dynamic Bed Clarifier



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