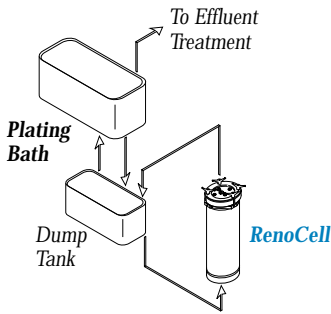
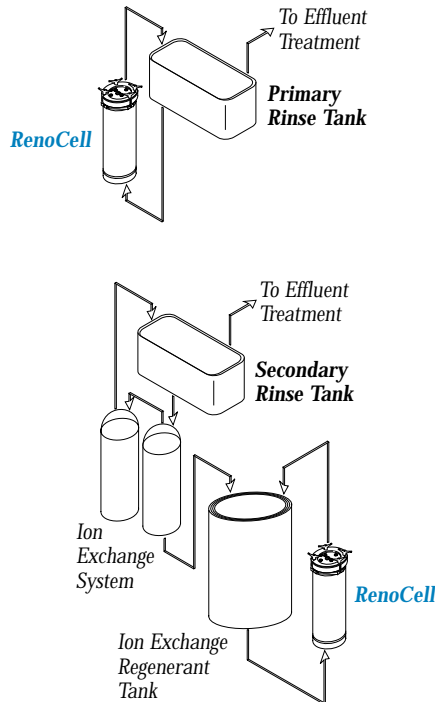


General Metal Finishing Process and Treatment

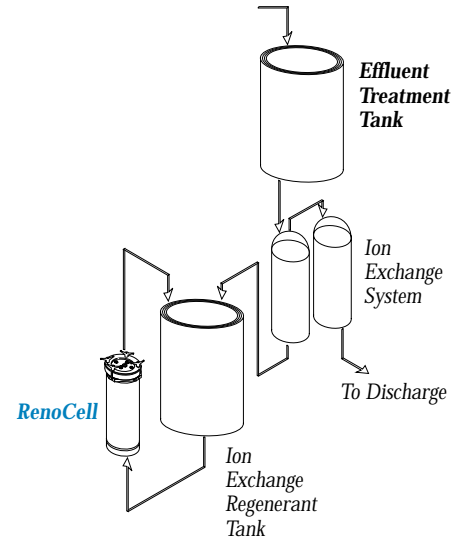
Baths



Rinses



Effluent Treatment



Introduction

RenoCell electrodeposition technology is applicable to the prevalent metals, and their complexes, that abound in the metal finishing industry. These metals include nickel, copper, cadmium, zinc, lead, tin, gold, silver, palladium, and chromium.

In this generic application, RenoCell technology focuses on waste minimization and metal recovery in the context of a complex and diverse set of issues associated with chemical-based solutions used in metal finishing operations.

These issues involve

- different types and concentrations of metals, concentrates and rinses;
- various volumes of metal-contaminated liquids;
- more stringent metal compliance levels associated with environmental regulations; and
- increasing process and water treatment costs.

Economic and Environmental Benefits

A “typical” metal finishing operation includes concentrated baths, rinses, and effluent treatment, as

illustrated in the model above. RenoCell provides metal finishers with several major benefits:

- Virtual elimination of metal-bearing hazardous sludges, which saves more than 40 percent in overall treatment costs
- Total operational cost savings up to 70 percent over conventional treatment methods
- Lower initial capital costs and a faster payback period
- Conformance with federal and local discharge compliance standards

Implications of RenoCell Application to Nickel-Specific Metal Finishing

A “typical” nickel metal finishing operation that generates approximately 5,200 pounds of nickel contamination per day in the process water can benefit greatly from the use of multiple RenoCells. When used as a source treatment, the RenoCells remove metal contaminants and virtually eliminate the production of hazardous metal-bearing sludges. The value of the nickel recovered using RenoCells in this type

of application minimizes annual operating costs and allows a two-year amortization of capital cost.

Bath Dumps

Concentrated bath dumps treated with RenoCell results in the removal of more than 3,000 pounds of nickel per year. The value of nickel recovered amounts to 135 percent of the annual costs associated with RenoCell operation.

Spent plating baths are a significant contributor to the generation of metal-bearing hazardous sludges. RenoCell removes increasing concentrations of metals accumulated in plating baths before the bath is considered spent. The spent bath must then be further treated or dumped and sent for final treatment prior to discharge.

The use of RenoCell results in a reduction of end-of-pipe treatment prior to discharge and allows the recovery of metal in elemental form for sale, reuse or non-hazardous disposal.

Rinse Maintenance

RenoCell can treat primary rinses through a "feed and bleed" approach. Twenty-five percent of the annual RenoCell operating costs are offset by the value of the recovered nickel metal.

In this continuous process, RenoCell efficiently and economically removes metals from the primary rinse. This allows water to be returned to the primary rinse and reused, resulting in a significant reduction in the costs associated with water supply and water discharge.

RenoCell also significantly reduces the cost of sludge

disposal that is prevalent with conventional treatment processes. Because RenoCell recovers elemental metal from the primary rinse, the metal can be sold, reused, or disposed off-site as a non-hazardous sludge.

Ion Exchange Enhancement

Secondary rinses and effluents are frequently treated using ion exchange. Ion exchange resins are regenerated with the appropriate chemical, which is called the regenerant. The cost of RenoCell treating the regenerant is 100 percent offset by the value of the recovered nickel.

In the ion exchange process, metals are removed to a level where the regenerant can be reused. RenoCell enhances ion exchange by providing an on-site source of resin regeneration, thus

further reducing the amount of resin needing to be purchased and eliminating the need to transport spent resins off-site for regeneration and disposal. Additional savings are realized because RenoCell recovers elemental metal from the regenerant, which can then be sold or disposed off-site as a non-hazardous sludge.

Conclusion

RenoCell is applicable and cost-effective in several areas of a generic metal finishing and treatment operation. When RenoCell is used as a source treatment, metal-bearing sludges are virtually eliminated. With respect to high-value metals, such as nickel, the value of the metal recovered more than offsets both capital costs and annual operating costs attributable to RenoCell.



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